

ACRP

REPORT

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Sponsored by
the Federal
Aviation
Administration

The National Academies of
SCIENCES • ENGINEERING • MEDICINE


TRANSPORTATION RESEARCH BOARD

AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP REPORT 102

**Guidance for Estimating
Airport Construction Emissions**

**Brian Kim
Kazumi Nakada**

WYLE, INC.
Arlington, VA

John Trendowski
C&S ENGINEERS, INC.

Syracuse, NY

Mary Vigilante
SYNERGY CONSULTANTS, INC.

Seattle, WA

Virginia Raps
ENVIRONMENTAL RESEARCH SCIENCES
Whitney, TX

Adrian Jones
ENVIRONMENTAL SCIENCE ASSOCIATES, INC.
San Francisco, CA

David Stonefield
Cary, NC

Subscriber Categories

Aviation • Construction • Environment

Research sponsored by the Federal Aviation Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.

2014

www.TRB.org

AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airlines for America (A4A), and the Airport Consultants Council (ACC) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

ACRP REPORT 102

Project 02-33

ISSN 1935-9802

ISBN 978-0-309-28376-2

Library of Congress Control Number 2013956409

© 2014 National Academy of Sciences. All rights reserved.

COPYRIGHT INFORMATION

Authors herein are responsible for the authenticity of their materials and for obtaining written permissions from publishers or persons who own the copyright to any previously published or copyrighted material used herein.

Cooperative Research Programs (CRP) grants permission to reproduce material in this publication for classroom and not-for-profit purposes. Permission is given with the understanding that none of the material will be used to imply TRB or FAA endorsement of a particular product, method, or practice. It is expected that those reproducing the material in this document for educational and not-for-profit uses will give appropriate acknowledgment of the source of any reprinted or reproduced material. For other uses of the material, request permission from CRP.

NOTICE

The project that is the subject of this report was a part of the Airport Cooperative Research Program, conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council.

The members of the technical panel selected to monitor this project and to review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical panel and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

The opinions and conclusions expressed or implied in this report are those of the researchers who performed the research and are not necessarily those of the Transportation Research Board, the National Research Council, or the program sponsors.

The Transportation Research Board of the National Academies, the National Research Council, and the sponsors of the Airport Cooperative Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of the report.

Published reports of the

AIRPORT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at

<http://www.national-academies.org/trb/bookstore>

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. C. D. Mote, Jr., is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. C. D. Mote, Jr., are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is one of six major divisions of the National Research Council. The mission of the Transportation Research Board is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied activities annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

COOPERATIVE RESEARCH PROGRAMS

CRP STAFF FOR ACRP REPORT 102

Christopher W. Jenks, *Director, Cooperative Research Programs*

Christopher Hedges, *Manager, Cooperative Research Programs*

Michael R. Salamone, *ACRP Manager*

Theresia H. Schatz, *Senior Program Officer*

Terri Baker, *Senior Program Assistant*

Eileen P. Delaney, *Director of Publications*

Scott E. Hitchcock, *Editor*

ACRP PROJECT 02-33 PANEL

Field of Environment

M. Kristoffer Russell, *Dallas/Fort Worth International Airport, Little Elm, TX* (Chair)

John K. Duval, *Austin Commercial, L.P., Los Angeles, CA*

Aimee Fenlon, (formerly) *Denver International Airport (DIA), Denver, CO*

Sam A. Mehta, *San Francisco International Airport, San Francisco, CA*

Teresa J. Raine, *ERM, Boston, MA*

David C. Reynolds, *Liesch Associates, Inc., Plymouth, MN*

Aimee Fisher, *FAA Liaison*

Dana Perkins, *FAA Liaison*

David J. Brzezinski, *US Environmental Protection Agency Liaison*

Tim A. Pohle, *Airlines for America Liaison*

Christine Grencher, *TRB Liaison*



FOREWORD

By **Theresia H. Schatz**

Staff Officer

Transportation Research Board

ACRP Report 102: Guidance for Estimating Airport Construction Emissions provides guidance and an interactive electronic tool [Airport Construction Emissions Inventory Tool (ACEIT), available on the CD accompanying this report: CRP-CD-142] to assist airports and other stakeholders in developing airport construction emissions inventories accurately and consistently.

As airports continue to expand and modify their infrastructure to meet the growing demand for air travel, they need to configure this growth within environmental constraints. Many airport projects, such as new or changes to existing runways, taxiways, aprons, terminal buildings, and parking facilities require construction activities. Airport projects that rely on federal funding are required to conduct National Environmental Policy Act (NEPA) studies to assess their environmental impact. Although emissions from construction equipment and associated activities are temporary in nature, they still must be accounted for, along with other applicable emissions sources in order to meet regulatory requirements.

While the understanding of emissions from various airport sources is improving, the methodology for calculating construction emissions remains highly variable. The FAA's Emissions and Dispersion Modeling System (EDMS), soon to be replaced by the Aviation Environmental Design Tool (AEDT), currently does not explicitly account for airport construction emissions, and few resources offer guidance for estimating such emissions. As such, there is inconsistency in determining estimated emissions levels based on what emission factors are used, how the construction equipment is characterized, and what activity data are used.

This research was conducted under ACRP Project 02-33 by Wyle, Inc., in association with C&S Engineers, Inc.; Synergy Consultants, Inc.; Environmental Research Sciences; Environmental Science Associates, Inc.; and David Stonefield. As part of the research, the team conducted literature reviews, developed and evaluated emission factors as well as activity data, and developed an electronic tool that underwent validation assessments.

A separate contractor's final report, which provides background on the research conducted in support of this guidebook and tool, has been posted on the ACRP Project 02-33 web page that can be found by searching the TRB website (www.trb.org) for *ACRP Report 102*.

CONTENTS

1	Chapter 1 Introduction
1	1.1 Project Overview and Purpose
2	1.2 Overview of ACEIT
3	1.3 Reasons for Developing Airport Construction Emissions Inventories
3	1.3.1 Compliance with NEPA
4	1.3.2 General Conformity Applicability Analyses/Conformity Determinations
5	1.3.3 Facility-Wide Inventories for SIP Purposes
6	1.3.4 Greenhouse Gas Emissions Inventories
6	1.4 Guidebook Organization
7	Chapter 2 Concepts and Considerations
7	2.1 Air Pollutants Associated with Construction Activities
9	2.2 Key Sources of Construction Emissions
13	2.3 Emissions Factors/Rates and Modeling
14	2.4 Project Types and Their Associated Activity Data
15	2.4.1 Site/Civil Project Categories and Activity Data
16	2.4.2 Vertical Construction Projects and Activity Data
17	2.5 Data Requirements and the Use of Defaults
18	2.5.1 Minimum Data Requirements
19	2.5.2 Resources to Improve Upon the Use of Defaults
23	Chapter 3 Emissions Calculations and Inventory Development
23	3.1 Levels of Analysis
23	3.2 Airport Construction Emissions Data
31	3.3 ACEIT Software Overview
32	3.4 ACEIT Software Features and Functionality
32	3.4.1 Setup (Minimum Required Data)
34	3.4.2 Project (Minimum Required Data)
37	3.4.3 Overall Size (Minimum Required Data)
37	3.4.4 Size Details
38	3.4.5 Activity: Non-Road
39	3.4.6 Activity: On-Road
41	3.4.7 Emission Factors: Non-Road
41	3.4.8 Emission Factors: On-Road
42	3.4.9 Fugitive
43	3.4.10 Menus
44	3.4.11 Running the Tool and Viewing the Outputs
46	3.5 ACEIT Tutorials
46	3.5.1 Example Level 1 Assessment
50	3.5.2 Example Level 2 Assessment
53	3.5.3 Example Level 3 Assessment

59	References
61	Acronyms
63	Appendix A Selected Construction Equipment Pictures
71	Appendix B Project, Activity, and Equipment
121	Appendix C Minimum Data Requirements for ACEIT
127	Appendix D ACEIT Assumptions List

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

CHAPTER 1

Introduction

1.1 Project Overview and Purpose

Each year, FAA approves many airport improvement projects. These projects range from small infrastructure renewal projects to entirely new cargo facilities, to new taxiways and runways, to new or expanded passenger terminals. Typically these improvements are designed to address specific airport needs, and those that are most visible to the community are designed to reduce excessive departure and arrival delays as well as to accommodate future growth in air travel demand. Airport lands are also being developed to accommodate non-aviation compatible uses such as shopping and warehousing for manufacturing and distribution to create buffer zones between the airport and surrounding developments and to generate revenue. Such approvals, including the funding of projects for changes to the airport layout, are also called federal actions.

Before FAA can take a federal action, the agency (often with the technical support of the airport sponsor) must comply with the National Environmental Policy Act (NEPA). NEPA requires the FAA to examine and disclose the potential effects of the proposed action (project) on environmental resources. In addition to NEPA, special purpose laws (such as the Clean Air Act) place additional requirements on federal approvals/actions and specify the thresholds and analysis framework for determining environmental impacts. Airports that are located in areas where the air quality does not meet federal standards (or has not in recent years) require compliance with the Clean Air Act requirement to show the projects conform to the State Implementation Plan (SIP) for meeting the standards (referred to as Conformity). The evaluations mandated under NEPA and General Conformity provisions of the Clean Air Act require the consideration of the effects of constructing the project on local air quality before such projects can be approved by the FAA. In general, all projects must go through a General Conformity evaluation to ensure the projects conform to the SIP.

The FAA has developed a suite of tools (models) that must be used for airport air quality evaluations. However, these FAA models do not presently evaluate emissions from construction activity. As a result, a number of EPA models, or models developed by state and local agencies, are used to evaluate airport construction emissions. Those models require an extensive knowledge of construction equipment and building processes so that the hours of use of specific equipment needed in the building process can be used. No consistent guidance is available concerning methods available to estimate construction processes. Thus, the approach used varies from airport to airport and project to project. In addition, to avoid prejudicing the federal action approval, FAA limits the amount of design and engineering of projects until an approval has been rendered. As a consequence, the details (such as exact numbers/models of vehicles, etc.) necessary to perform air quality analysis calculations are often not readily known/available and must be estimated using the variable subjective judgment of individuals whose knowledge and experience vary as well.

Currently, no standard tool exists for modeling airport construction emissions.

2 Guidance for Estimating Airport Construction Emissions

To address the gap in modeling capability and guidance regarding airport construction emissions, TRB, under ACRP, initiated ACRP Project 02-33. The purpose of the project is to develop guidance and a supporting software tool to allow users to better understand and quantify airport construction emissions, and also to bring consistency to airport construction emissions inventories. While this Guidebook provides background information, it has been designed to facilitate emissions calculations using the Airport Construction Emissions Inventory Tool (ACEIT). The tool enables users to rely upon default information about the construction process for the typical airport projects. The Guidebook provides information to enhance the user understanding of the construction process and information needed to improve the quality of emissions inventories developed by using default settings and data in the tool. Details regarding how the project was conducted as well as data, methods, and assumptions are documented in the Final Report, which is available on the project description page: <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3034>.

1.2 Overview of ACEIT

Developed in concert with this Guidebook, ACEIT facilitates the modeling of airport construction emissions scenarios. ACEIT provides default values for most input data (e.g., activity data, emission factors, etc.), but allows expert analysts to provide their own activity data to model more accurate scenarios. On the most basic level, the ACEIT allows a user to accept default data defining a project's construction plan. To improve the results of the default assumptions, ACEIT allows experienced analysts to refine scenarios by selecting from a comprehensive list of activities and equipment that corresponds to the selected project types. It also allows for the manipulation of various options and parameters to better define the project scenario.

ACEIT uses default emission factors derived from EPA-approved emissions models for non-road construction equipment and on-road vehicles. The default activity data used in ACEIT is derived from engineering expertise and the collective experiences of members of the research team who have successfully developed airport construction emissions inventories for various past projects.

Figure 1-1 shows the ACEIT title screen that is first presented to the user as the tool loads the necessary system data. The tool itself uses a single window with multiple tabs to allow the user



Figure 1-1. ACEIT title screen.

to input known data about each project and then to refine the default data to more accurately portray local and project-specific construction practices (if known). The tool provides a help file of instructions and hints on the tool's functionality.

The concepts, methods, and data presented in this Guidebook are completely consistent with ACEIT. However, due to the complexities of the emissions calculations and the large datasets involved, users of this Guidebook are expected to use ACEIT to perform emissions calculations.

As a word of caution, this Guidebook and ACEIT should only be used for airport construction emissions calculations, NEPA compliance, and General Conformity assessments. Neither the Guidebook nor ACEIT should be used to calculate emissions for non-airport projects, in support of Transportation Conformity assessments, or to develop SIP emission budgets for projects not associated with airports. In general, Transportation Conformity is required for areas designated nonattainment and maintenance for any highway or transit project that is proposed to receive funding assistance and approval through the Federal Aid Highway program or the Federal Mass Transit program, or requires FHWA or FTA approval. In contrast, General Conformity is required for all federal actions that do not include FHWA/FTA projects as defined in 40 Code of Federal Regulations (CFR) 93.101.

Users are not expected to manually develop airport construction emissions inventories; rather, they will use ACEIT because of the complexity of the calculations.

Caution: The Guidebook and tool should not be used for Transportation Conformity or related evaluations.

1.3 Reasons for Developing Airport Construction Emissions Inventories

The FAA, airport operators, and other parties prepare construction emissions inventories to demonstrate regulatory compliance and support air quality policy on the local, state, and federal levels, including the following:

- Compliance with NEPA
- Clean Air Act General Conformity applicability analyses/Conformity determinations
- Preparation of facility-wide inventories to support SIPs
- Greenhouse gas emissions inventories

Each of these needs brings certain requirements that may be regulatory in nature. Therefore, familiarity with these requirements will ensure the highest accuracy relative to that need.

Understanding the need for an airport construction emissions inventory will help to determine how best to balance available data and resources with the fidelity of the inventory.

1.3.1 Compliance with NEPA

Whenever a federal agency approves an action, that agency is required to comply with NEPA. Federal actions relative to an airport can include approval of the Airport Layout Plan (ALP), approval of funding under the Airport Improvement Program (AIP), use of passenger facility charges (PFCs), leases of federal land, etc. FAA Order 1050.1E *Environmental Impacts: Policies and Procedures* (FAA 2006) identifies the approach used by FAA to comply with NEPA, while FAA Order 5050.4B further focuses on the NEPA procedures associated with airport improvement projects. In general, NEPA compliance can be completed through the preparation of categorical exclusion reports, Environmental Assessments (EAs), and Environmental Impact Statements (EISs).

FAA guidance for NEPA compliance requires that the effects of the proposed action on air quality be assessed. Air quality effects may be a result of emissions from the equipment used

4 Guidance for Estimating Airport Construction Emissions

to construct the various development components associated with the action, or they may be from emissions associated with the airport's ongoing operation upon project completion, such as aircraft taxiing along a newly constructed taxiway. For the majority of cases in which construction emissions are evaluated, the assessment is completed through preparation of an emissions inventory. Only in unusual circumstances, such as within extreme nonattainment areas or significant projects, is the impact of construction emissions discerned through dispersion modeling, which involves the use of an air quality model to predict the movement and dispersion of an air pollutant(s) in order to calculate concentrations at specified receptor locations. If a dispersion analysis were required, it would typically be preceded by an emissions inventory such as that developed using ACEIT and the identification of construction activity associated with the project.

1.3.2 General Conformity Applicability Analyses/Conformity Determinations

The Clean Air Act requires the EPA to protect public health and welfare from the effects of air pollution. Through Section 109 of the Clean Air Act, the EPA has established National Ambient Air Quality Standards (NAAQS). Areas that do not meet the NAAQS are referred to as nonattainment areas; areas that have achieved the standards, but have a past nonattainment designation, are referred to as maintenance areas. Section 110 of the Clean Air Act requires states to implement plans for attaining or maintaining the NAAQS through the SIPs.

In addition to the requirements of NEPA, a federal agency can approve a federal action located in a nonattainment or maintenance area when the agency demonstrates that the action will conform to the EPA-approved attainment demonstration SIP. The Clean Air Act Conformity regulations (40 CFR Part 93) ensure that actions taken by federal agencies in nonattainment and maintenance areas do not interfere with the state's plan for meeting the NAAQS. Conformity for actions of FHWA and FTA are completed through Transportation Conformity (40 CFR Part 93, Subpart A), whereas most other Conformity evaluations follow the General Conformity regulations (40 CFR Part 93, Subpart B). The substantial majority of actions by the FAA require compliance under General Conformity in a nonattainment or maintenance area.

One of the requirements of the General Conformity regulation is the consideration of total direct and indirect project-related net emissions, which EPA has interpreted to include construction emissions. The General Conformity regulation process for airport actions typically consists of several steps:

- a. First, a review of the FAA's list of actions presumed to conform is conducted. If one of the proposed activities is on the list and meets the requirements of the project, that activity is excluded from the construction emissions inventory, as the action is presumed to conform.
- b. Next, a General Conformity applicability analysis is conducted. As part of the applicability analysis, the sum of direct and indirect project-related emissions, as evaluated through an emissions inventory, is calculated. The total of direct and indirect emissions is contrasted with the applicable *de minimis* threshold for the nonattainment/maintenance area. This evaluation consists of an inventory of construction-related emissions as well as changes in ongoing operational emissions after construction is completed. The analysis is only conducted for those pollutants for which the area in question is in nonattainment/maintenance [e.g., oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) are evaluated for an ozone nonattainment/maintenance area]. Table 1-1 provides the list of General Conformity *de minimis* threshold levels.

An example of a Conformity applicability analysis summary is shown in Table 1-2. This example deliberately does not specify the pollutant that is the subject of Conformity, and is

Table 1-1. Example applicability.

Pollutant	Area Type	Tons/Year
Ozone (VOC or NO _x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO _x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
CO (carbon monoxide), sulfur dioxide (SO ₂) and nitrogen dioxide (NO ₂)	All nonattainment & maintenance	100
PM-10	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
Lead (Pb)	All nonattainment & maintenance	25

Source: EPA, August 13, 2013. <http://www.epa.gov/airquality/genconform/deminimis.html>.

presented for illustration purposes only; an applicability analysis must be conducted for each pollutant that is in nonattainment or maintenance areas.

- c. If the project-related net emissions increase is below the *de minimis* threshold, the project is presumed to conform. If project-related net emissions is equal to or greater than the *de minimis* threshold, a Conformity determination is required. Users should consult the General Conformity regulations and the 2002 General Conformity Guidance for Airports (FAA/EPA 2002), prepared by the FAA and EPA for the steps/requirements of a Conformity determination.

1.3.3 Facility-Wide Inventories for SIP Purposes

In 2010, the EPA amended the General Conformity regulations to create a streamlined approach for those projects that are reflected in the SIP, thus creating an incentive to participate in the SIP preparation process. This streamlined approach encourages facilities, such as airports, to be represented in the SIP through a facility-wide budget. If the project-related emissions are reflected in the facility-wide budget, Conformity can be demonstrated by showing that the emissions are captured in the facility-wide emissions budget (40 CFR 93.161).

A number of airports have already prepared facility-wide inventories, which are reflected in their applicable SIPs. Because construction-related emissions must be considered in General

Table 1-2. Example applicability analysis (tons per year emissions).

Year	Project-Related Net Pollutant Emissions (tons/year)	Are Project-Related Net Emissions <i>De Minimis</i> ?
Year 2014 (construction emissions—9 months)	22	Yes
Year 2015 (1st year operational emissions)	38	Yes
Year 2025 (peak-year emissions)	42	Yes
<i>De minimis</i> (maintenance area)	100	

Note: Sources reflect direct and indirect emissions. This analysis is undertaken for all pollutants that the area is in nonattainment or maintenance, and the *de minimis* threshold may vary by pollutant.

6 Guidance for Estimating Airport Construction Emissions

Conformity analyses, these facility-wide emissions budgets may need to include construction emissions inventories for future projects. ACRP Project 02-21, “Evaluation of Airport Emissions within State Implementation Plans,” published as *ACRP Report 84: Guidebook for Preparing Airport Emissions Inventories for State Implementation Plans* (KB Environmental Sciences, Inc. et al. 2012) developed guidance for airport operators on preparing inventories for SIP purposes. By design, that guidebook focused on all emissions with the exception of those associated with a project’s construction. The *ACRP Report 84*, coupled with this Guidebook, provides a standard methodology for users wishing to create a facility-wide inventory. However, this Guidebook and ACEIT should not be used for purposes of evaluating Transportation Conformity or in connection with Transportation Conformity SIP purposes, as the methodology does not meet the EPA’s requirements for such work.

1.3.4 Greenhouse Gas Emissions Inventories

Users may also wish to prepare a construction activity greenhouse gas emissions inventory. While a greenhouse gas inventory is not presently required for either NEPA or Conformity purposes, other needs for such inventories may exist. For example, an airport operator may wish to develop a greenhouse gas inventory as part of a climate action plan or as part of a larger sustainability program. These programs may be implemented through voluntary measures or through local government requirements. In either case, the tracking of greenhouse gas emissions can also serve as an indication of fuel/energy consumption at airports since a direct correlation exists between greenhouse gas emissions and energy use.

1.4 Guidebook Organization

Chapters 1 and 2 serve as a primer for understanding airport construction emissions.

This Guidebook is structured to provide background information for novice users as well as information for experienced users. First-time users and those wanting to gain a better understanding of the issues involved in estimating construction emissions will ideally start with the first two chapters (1 and 2). Chapter 1 provided an overview of the ACRP project including project goals and objectives. This was followed by a presentation of reasons for developing airport construction emissions inventories covering NEPA and General Conformity-related discussions.

Chapter 2 covers various concepts and issues associated with assessing and developing airport construction emissions inventories. These concepts/issues include the types of air pollutants, key sources of construction emissions, emissions modeling, construction activity data, and data requirements for emissions calculations. Taken as a whole, Chapters 1 and 2 can serve as a primer for better understanding the development of airport construction emissions inventories.

Knowledgeable users and those who have previously reviewed Chapters 1 and 2 can potentially jump directly to Chapter 3. This final chapter provides an overview regarding construction emissions calculations and instructions on the use of ACEIT. In addition to explaining how the tool is to be used, Chapter 3 provides several tutorials to demonstrate the different methods and datasets that can be employed to develop an inventory of construction emissions, referred to in this Guidebook as Level 1, Level 2, and Level 3. This Guidebook concludes with a list of references and acronyms as well as appendices of supporting information.

CHAPTER 2

Concepts and Considerations

This chapter identifies a number of issues that users preparing construction emissions inventories should understand. These considerations ensure that the emissions inventory achieves its desired purpose and the fidelity of the inventory is able to adequately support the intended project.

2.1 Air Pollutants Associated with Construction Activities

Table 2-1 presents a comprehensive list of criteria air pollutants and greenhouse gases commonly associated with construction activities and shows the pollutants that are addressed in this Guidebook. Additional information regarding the pollutants addressed in this Guidebook is provided following Table 2-1.

Carbon Monoxide (CO)

CO is a highly toxic, odorless, colorless gas formed by the incomplete combustion of fuels. The health effects associated with exposure to CO are related to its affinity for hemoglobin in the blood. At high concentrations, CO reduces the amount of oxygen in the blood, causing heart-related difficulties in people with chronic diseases, reduced lung capacity, and impaired mental function. At construction sites, CO is produced from combustion activities, mainly from equipment exhaust and from the burning of waste materials.

Oxides of Nitrogen (NO_x)

NO_x is a family of gases made up of NO and NO₂ formed from combustion under high temperature conditions involving molecular nitrogen (N₂) and oxygen (O₂) mainly from the air, although elemental contributions of N and O from the fuel are also possible. NO_x emission rates are highest during high engine power conditions (e.g., vehicle acceleration). As a pollutant, NO_x is known to cause direct respiratory failure, and is also a well-known precursor to ozone (O₃). Physical effects associated with O₃ include chest discomfort, coughing, nausea, respiratory tract and eye irritation, and decreased pulmonary (lung) function. The main source of NO_x at construction sites is the exhaust from off-road equipment and on-road vehicles.

VOC

VOCs are a group of chemicals, predominantly hydrocarbons, with relatively high vapor pressures and participants in photochemical reactions. They are emitted as products of incomplete combustion especially under lower temperature and fuel-rich environments. They can also be emitted through volatilization from various hydrocarbon-related sources including equipment fuels, painting operations, stored materials, etc. VOCs have a wide variety of health effects, some

Table 2-1. Pollutants emitted from construction activities.

Pollutant Category	Pollutants Associated with Construction Activities	Pollutants Included As Part of This Guidebook
Criteria pollutants and precursors	<u>Criteria pollutants</u> - Carbon monoxide (CO) - Ozone (O₃) - Sulfur dioxide (SO₂) - Nitrogen dioxide (NO₂) - Particulate matter with aerodynamic diameter of 10 micrometers (µm) or less (PM₁₀) - Particulate matter with aerodynamic diameter of 2.5 µm or less (PM_{2.5}) <u>Precursor pollutants</u> - Oxides of nitrogen (NO_x) - VOCs - Ammonia (NH₃) - Nitrogen oxide (NO) - Total hydrocarbons (THC) - Non-methane hydrocarbons (NMHC) - Total organic gases (TOG) - Non-methane organic gas (NMOG)	- CO - NO_x and VOC - SO₂ - PM₁₀ - PM_{2.5} - NO_x - VOC
Greenhouse gases	- Carbon dioxide (CO₂) - Methane (CH₄) - Nitrous oxide (N₂O) - Sulfur hexafluoride (SF₆) - Perfluorocarbons (PFCs) - Hydrofluorocarbons (HFCs)	- CO₂ - CH₄ - N₂O
Hazardous air pollutants (HAPs)	- Benzene - Ethanol - Methyl tertiary-butyl ether (MTBE) - Naphthalene 1,3-Butadiene - Formaldehyde - Acetaldehyde - Acrolein - Etc.	None (except as included within VOCs and PM)

of which include eye, nose, and throat irritation, headaches, nausea, damage to the liver and kidneys, and cancer. VOCs are also well-known precursors of O₃. During construction activities, VOCs can be emitted through equipment exhausts and from fugitive sources such as fuel storage and transfer, paving activities, and surface coating.

Sulfur Dioxide (SO₂)

SO₂ is formed when fuel that contains sulfur (typically, coal and oil) is burned during the metal smelting process and during other industrial processes. High concentrations of SO₂ are found in the vicinity of large industrial facilities. During the combustion of fuel, SO₂ emissions are produced from the oxidation of the sulfur content in the fuel. Generally on a large-scale, SO₂ can contribute to acid rain, which can cause both health and welfare problems. The physical effects of SO₂ include temporary breathing impairment, respiratory illness, and aggravation of existing cardiovascular disease. Children and the elderly are most susceptible to the negative effects of exposure to SO₂. Since new equipment requires ultra-low sulfur content fuels, SO₂ emissions are not generally a major concern at construction sites.

Coarse Particulate Matter (PM₁₀) and Fine Particulate Matter (PM_{2.5})

Particulate matter consists of solid and liquid particles of dust, soot, aerosols, and other matter small enough to remain suspended in the air for a long period of time. PM₁₀ refers to particulate

matter less than 10 μm in aerodynamic diameter and $\text{PM}_{2.5}$ refers to particulate matter less than 2.5 μm in aerodynamic diameter. These two size classes represent that portion of particulate matter thought to represent the greatest hazard to public health. Particulate matter can accumulate in the respiratory system and is associated with a variety of negative health effects. Exposure to particulates can aggravate existing respiratory conditions, increase respiratory symptoms and disease, decrease long-term lung function, and possibly cause premature death. Generally, the smaller the size of the particulate matter, the greater the chance for deeper penetration into the respiratory system, which increases the potential for greater impacts. The segments of the population that are most sensitive to the negative effects of particulate matter in the air are the elderly, individuals with cardiopulmonary disease, and children. Aside from the negative physical effects, particulate matter in the air reduces visibility and damages paint and building materials.

A portion of particulate matter in the air comes from natural sources, such as windblown dust and pollen. Manmade sources of particulate matter include combustion of materials, operation of automobiles, field burning, operation of factories, vehicle movement or other manmade disturbances of unpaved areas, and photochemical reactions in the atmosphere. Secondary formation of particulate matter also occurs where sulfur and nitrogen-based species may interact with other compounds in the air. Particulate emissions at construction sites come from a variety of sources. Equipment and vehicles emit particles in exhaust as well as from brake and tire wear. Land-clearing and earth-moving operation can include waste-burning and removal of protective covers exposing the area to wind erosion.

Greenhouse Gases

Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) because their effect is to heat the atmosphere of the earth. The accumulation of GHGs has been implicated as a driving force for global climate change. Definitions of climate change vary between and across regulatory authorities and the scientific community, but in general it can be described as the changing of the earth's climate caused by natural fluctuations and anthropogenic activities (i.e., activities relating to, or resulting from, the influence of human beings) that alter the composition of the global atmosphere.

The primary GHG is CO_2 simply due to the sheer magnitude of its emission on a global basis. CO_2 is the "reference gas" for greenhouse gas emissions, meaning that emissions of total GHGs are typically reported in carbon dioxide equivalent (CO_{2e}). CH_4 and N_2O emissions are also commonly included in GHGs emissions inventories. Also, SF_6 , PFCs, and HFCs are also included in the inventories when applicable sources are included and data is sufficient. Although the presence of the primary GHGs in the atmosphere is naturally occurring, the aforementioned GHGs are largely emitted from human activities, accelerating the rate at which these compounds accumulate in the earth's atmosphere. Individual projects contribute to the cumulative effects of climate change by emitting GHGs during demolition, construction, and operational phases. The main source of GHGs (especially CO_2) at construction sites is the combustion of fuel by equipment.

2.2 Key Sources of Construction Emissions

Emissions from construction activities vary substantially based on the type of project(s) being constructed, local construction practices, and climate of the area (i.e., temperatures). Emissions can be categorized as indicated below and illustrated in Figure 2-1:

- Exhaust (emissions from the tailpipe of the equipment)
- Fugitive/evaporative (emissions that do not pass through a tailpipe)

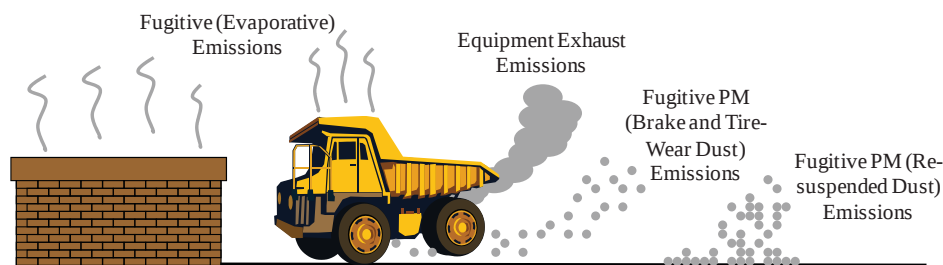


Figure 2-1. Equipment exhaust and fugitive emissions.

Most construction activity emissions can be categorized as the following:

- Site preparation—vehicle exhaust and fugitive
- Building (sometimes separating paving from erecting a building)—primarily vehicle exhaust
- Asphalt and concrete paving work and batching—vehicle exhaust and fugitive
- Material delivery (import and export of fill, or other materials needed)—exhaust and fugitive
- Construction employee work commute—primarily vehicle exhaust
- Painting/striping—primarily fugitive

Most construction activity is identified in SIPs as a non-road source of emissions.

Relative to how EPA characterizes sources for SIP purposes, construction equipment is generally considered non-road equipment; to complete a large portion of the mission (construction), the equipment typically does not travel on area roadways. However, there are some construction-related vehicles that are used on roadways, including different types of trucks used to transport materials (e.g., concrete mixers, dump trucks transporting dirt and aggregate, etc.) as well as the construction workers who commute to the worksite. Some examples of construction equipment types are shown in Figure 2-2. Pictures of selected, common construction equipment types used at airports are presented in Appendix A. This visual resource can be used to better understand the sizes, shapes, and uses of the equipment rather than simply referring to them in terms of horsepower ranges or other variables.

Table 2-2 provides an overview of the source categories and sub-categories of air pollutant emissions from construction activities. The pollutants typically associated with each source category/sub-category are also presented.

The sources noted in Table 2-2 are elaborated below:

- **Vehicle Exhaust Combustion Sources:** Construction equipment encompasses both vehicles and any other equipment used in construction activities. This category is generally associated with emissions that are not only directly emitted from the source and based on combustion of a fuel, but with some fugitive sources as well.
 - **Non-Road Equipment:** Non-road equipment is generally operated off-road and on construction sites. Non-road construction equipment includes sources that are mobile (e.g., bulldozers, backhoes, front-end loaders, etc.) and stationary (e.g., diesel generators, lifts/cranes, etc.). A large proportion of non-road equipment uses diesel fuels (e.g., diesel, ultra-low sulfur diesel, etc.) but it is noted that some equipment uses other fuel types including gasoline, liquid petroleum gas (LPG), compressed natural gas (CNG), and electricity. Non-road equipment is a source of combustion/exhaust emissions and fugitive emissions including brake wear and tire wear emissions and non-exhaust evaporative emissions. Operation of non-road equipment on unpaved portions of a construction site and/or unpaved roads can result in fugitive dust emissions. Some equipment such as material transport trucks can

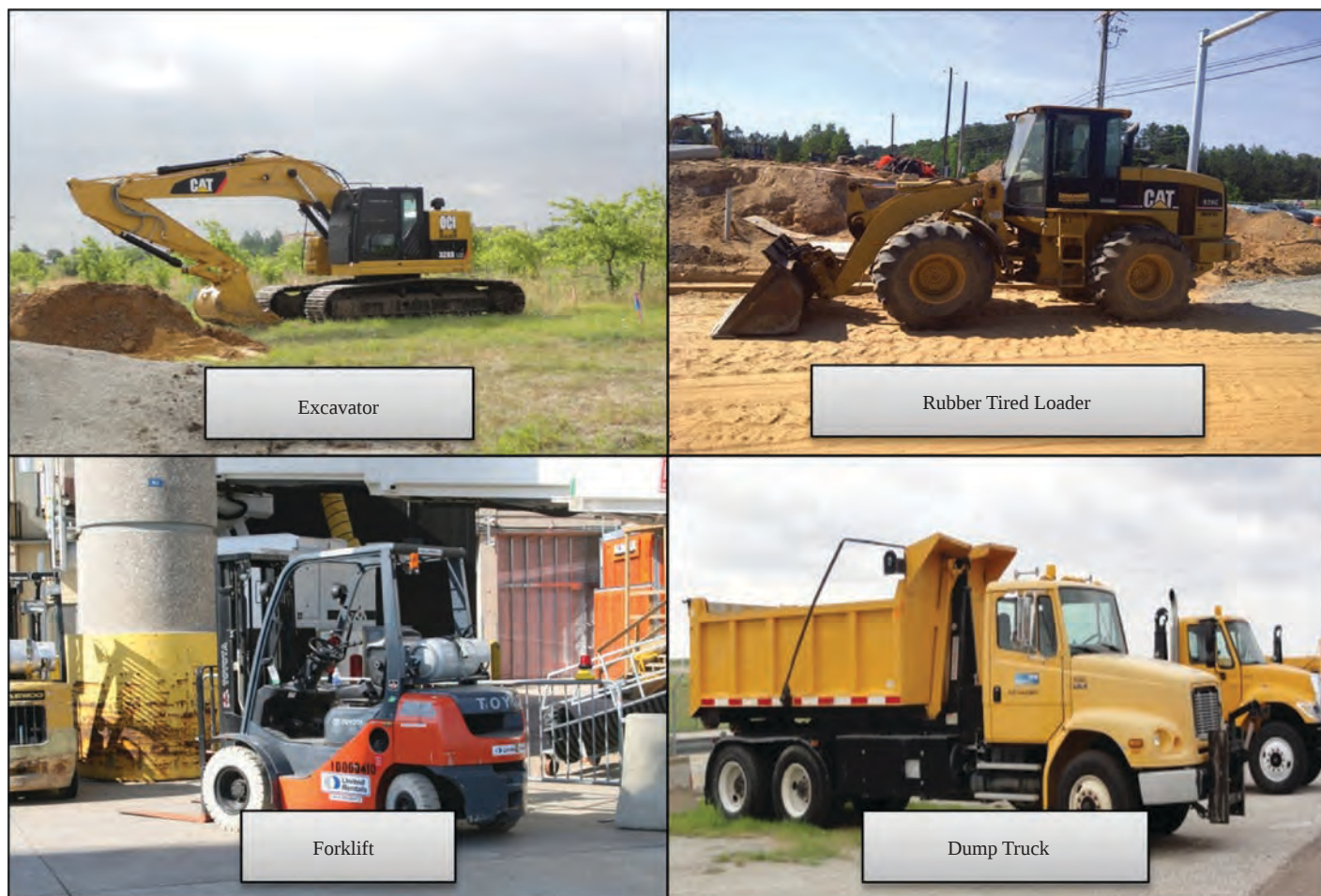


Figure 2-2. Example construction equipment types (top left, top right, bottom left photos provided by Kris Russell of Dallas/Fort Worth International Airport; bottom right photo by Wyle, Inc.).

Table 2-2. Potential sources of criteria air pollutant emissions and GHG emissions—construction activities.

Source Type	Source Sub-Categories	Associated Pollutants
Combustion	• Non-road equipment (on-site construction) • On-road equipment (material delivery from off-site, construction employee work commute) • Batch plants (asphalt and concrete)	• CO, NO_x, SO₂, VOCs, PM₁₀, PM_{2.5}, CO₂, N₂O, CH₄
Fugitive	• Dust (PM) emissions ◦ Earth moving (grading, excavation, etc.) ◦ Wind erosion (soil) ◦ Material handling and drop activities ◦ Travel on paved and unpaved roads (re-entrained road dust) ◦ Demolition ◦ Material batching • Evaporative/volatilization emissions ◦ Asphalt paving (drying) ◦ Surface coating and painting ◦ Roof tar (drying) ◦ Fuel storage/transfer ◦ Material batching	• PM₁₀, PM_{2.5}, VOCs

be considered non-road equipment when operating on construction sites, while it can be considered on-road equipment when operating on roadways/highways.

- **On-Road Equipment:** In contrast to non-road construction equipment that primarily operates on unpaved surfaces, on-road construction equipment can be operated on public roads. Most on-road construction equipment is powered by diesel and gas but some use LPG, CNG, electricity, or alternative fuels including bio-diesel. Construction employee vehicle trips to and from the work site each day and construction hauling trips (off-site truck trips) are examples of on-road construction equipment in action. On-road construction equipment is a source of combustion/exhaust emissions and fugitive emissions including brake wear and tire wear emissions and non-exhaust evaporative emissions. Operation of on-road equipment on unpaved portions of a construction site and/or on unpaved roads can result in fugitive dust emissions. Some equipment such as material transport trucks can be considered non-road equipment when operating on construction sites, while it can be considered on-road equipment when operating on roadways/highways.
- **Batch Plants (Asphalt and Concrete):** In addition to fueled equipment, asphalt batch plants also typically generate exhaust emissions. The most significant source of emissions of most pollutants from batch mix plants is the rotary drum dryer. The dryer emissions consist of water (as steam evaporated from the aggregate), PM, products of combustion (CO and NO_x), and small amounts of organic compounds of various species (including VOC). The CO and VOC emissions result from incomplete combustion of the fuel. Some concrete batch plants are powered by diesel generators and hence, can also be a source of exhaust emissions such as CO and NO_x.
- **Fugitive Emission Sources:** 40 CFR 51.166(b)(20) defines fugitive emissions as “those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.” For the purposes of this Guidebook, fugitive emissions sources have been divided into two broad categories: fugitive dust and volatilization/evaporative. Fugitive emissions sources related to construction activities are described below.
 - **Dust (Particulate Matter) Emissions:**
 - **Earth-Moving Activities:** Earth-moving activities during construction (e.g., grading, cutting, filling using bulldozers, scrapers, compactors, etc.) can be a source of fugitive dust (PM₁₀) emissions.
 - **Wind Erosion:** Dirt piles, aggregate piles, areas of bare soils, and newly paved portions of a construction site can be a source of windblown PM₁₀.
 - **Material Handling and Drop Emissions:** Fugitive dust can result from the delivery of aggregate and other “dusty” materials to a construction site.
 - **Travel on Paved and Unpaved Roads:** Non-road and on-road vehicle movements on paved and unpaved roads near construction sites can be a source of re-entrained road dust (PM₁₀). Brake and tire wear also contribute to these fugitive PM emissions.
 - **Demolition:** Building demolition and other demolition activities can be a source of fugitive dust emissions (PM₁₀) and potentially a source of hazardous air pollutants (e.g., asbestos).
 - **Material Batching:** The process of transferring, heating, and mixing materials during the batching process can result in fugitive PM emissions, especially PM₁₀.
 - **Evaporative/Volatilization Emissions:**
 - **Asphalt Paving Operations:** Asphalt surfaces and pavements are composed of compacted aggregate and an asphalt binder. Aggregate materials are produced from rock quarries as manufactured stone or are obtained from natural gravel or soil deposits. Asphalt binders take the form of asphalt cement (the residue of the distillation of crude oils), and liquefied asphalts. Asphalt cement, which is semisolid, must be heated prior to mixing with aggregate. Asphalt paving operations can be a source of VOC emissions. VOC emissions

are created by the evaporation of the petroleum distillate solvent, or diluents, used to liquefy asphalt cement.

- **Surface Coating and Painting:** VOC emissions can result from the evaporation of solvents contained in paints, varnishes, primers, and other surface coatings.
- **Roof Tar Drying:** Roof tar is similar to asphalt and can be a source of VOC emissions as a result of evaporation.
- **Fuel Storage/Transfer:** Fuel storage tanks on construction sites can be a source of VOC emissions, particularly when fuel is transferred to on-road and non-road construction equipment.
- **Equipment Operations:** On-road and non-road equipment can be a source of evaporative releases of VOCs during operation and when they are not in operation (e.g., fuel leaks, permeation, vapor venting, etc.).
- **Material Batching:** The process of transferring, heating, and mixing materials during the batching process can result in fugitive VOC emissions when they are not captured through ducts.

2.3 Emissions Factors/Rates and Modeling

The primary model required for use in evaluating airport-related emissions sources is the FAA's Emissions and Dispersion Modeling System (EDMS) (FAA 2010). This model currently does not include construction equipment. Therefore other models and datasets are required to prepare construction emissions inventories. Note that the FAA is transitioning its emissions models to a new tool called the Aviation Environmental Design Tool (AEDT). For purposes of this Guidebook, EDMS and AEDT refer to the same FAA emissions processes. AEDT local, which will evaluate emissions in the local airport setting, is expected to be available in 2014. AEDT local is not expected in its early versions to include construction-related emissions. The two main emission factor models used to develop the Guidebook and ACEIT are the EPA's non-road equipment emissions model (NONROAD) and the Motor Vehicle Emissions Simulator (MOVES) (EPA 2009 and 2012). As the name implies, NONROAD provides predictions of emissions inventories from which emission factors can be derived for equipment typically used for non-road (off-road) purposes, including construction activities. In contrast, MOVES is used to develop emissions inventories and emission factors for on-road vehicles. Both exhaust and fugitive (e.g., evaporative) emission factors were developed using these models for non-road construction equipment and on-road vehicles that were incorporated into ACEIT.

Emission factors represent one key input needed to calculate pollutant emissions. An example of a relatively simple equation used to calculate exhaust emissions from non-road construction equipment is as follows:

$$E = EF \times P \times LF \times A$$

where

E = emissions (e.g., g)

EF = emission factor [e.g., g/horsepower hour (hp-hr)]

P = rated power (e.g., hp)

LF = load factor (fraction)

A = activity data [e.g., hours of use (hr)]

Complexities can be introduced for both the emission factor as well as the activity data such that the calculation of emissions can be more difficult and time-consuming. For example, emission factors may be a function of atmospheric conditions (e.g., temperature), vehicle type,

vehicle age, fuel characteristics, etc. The emission factors are usually obtained from EPA models that typically use a core emission factor as the starting basis and then introduce other variables to develop emission factors that are more specific to the needs of a project.

In addition to these emissions, fugitive emissions related to non-exhaust and non-equipment sources also need to be included to develop a comprehensive emissions inventory. Unlike exhaust emissions, the emission factors for evaporative emissions from these models have units of mass per day for each vehicle (e.g., g/day-veh). This is due to the fact that evaporative emissions occur when equipment is running as well as when it is turned off (e.g., hose permeation, diurnal effects, etc.). However, fugitive brake and tire wear PM emissions have the same units as exhaust emissions. Models such as NONROAD and MOVES can be used to model these types of fugitive emissions. Fugitive emissions from other types of sources including, but not limited to, asphalt batch plants, asphalt drying, soil handling, and material movement require the use of methods from the EPA's AP-42 (compilation of emission factors) (EPA 1995). For example, fugitive emissions resulting from material movement involving re-suspended roadway dust can be calculated from the following complex equation with many variables:

$$E = 1.5 \times (s/12)^{0.9} \times (W/3)^{0.45} \times VMT$$

where

E = PM_{10} emissions (lb)

s = surface material silt content (%) = 13.5% default median

W = mean vehicle weight (tons)

VMT = vehicle miles traveled (mi)

Similar to the default emission factors for exhaust emissions, default values for the variables used in these types of fugitive emissions equations have also been developed. The user needs to decide if the resulting default emissions are adequate or if more accurate data can be obtained to calculate more representative emissions.

2.4 Project Types and Their Associated Activity Data

A key component in calculating construction emissions is the construction equipment activity data (herein referred to as activity data). Conceptually, it is one of the two primary pieces of information (emission factor and activity data) necessary to create an emissions inventory. Activity data represent the amount of time that individual types of equipment are being used on a specific project. Thus, at a minimum, the user must first identify the project or group of projects that are to be evaluated. Improvements in this data can be through understanding the activity types and/or phases that may constitute a project, and the specific equipment and time of use during each activity type. While a very basic emissions inventory can be prepared if only the basic dimensions of a project are known, the inventory results are much improved if the user has an understanding of the activities that would be undertaken in completing construction (sometimes called project phases or activities).

To illustrate the consideration of project activity, an example of building a new airport roadway is used. The example roadway would be ¼ mile long and consist of two lanes with shoulders. Information might stop at just that information. The default activities used in the ACEIT tool consist of 12 associated activities including a) clearing/grubbing, b) erosion control, c) excavation, d) subbase placement, e) dust control, f) grading, g) asphalt placement, h) concrete placement, i) drainage, j) roadway lighting, k) security fencing, and l) landscaping (topsoil placement, hydroseeding, marking, and tree planting). By knowing the road dimensions (two lanes for ¼ miles) and the various activities that are needed, one can then estimate the types of equipment

and their use. The ACEIT tool contains default information for standard airport projects, including associated activity types and the equipment used in each activity. Based on the dimensions, the tool scales these default activities. However, as will be shown later, the tool enables the user to define the activities or to tailor the default activities to the local construction practices.

To aid the user in identifying the types of activities associated with a project, the Guidebook and ACEIT include two types of construction projects that represent the significant majority of construction that typically occurs at an airport, as follows:

Two types of construction projects: site/civil and vertical construction.

1. Site/civil projects
2. Vertical construction (buildings)

Within these two categories, the Guidebook and ACEIT have 35 different projects: 24 site/civil project categories (e.g., site preparation, airfield projects, aprons, etc.) and 11 vertical construction projects (e.g., buildings and other structures). These 35 project types are representative of the substantial majority of airport improvement projects. ACEIT then identifies the various activities that are typical to the average airport project, and, based on the dimensions of the project (such as the two-lane, 1/4-mile roadway project), the amount of time construction equipment would be used for each activity. Appendix B presents the combination of projects and activities as well as construction equipment associated with each project.

In order to develop an airport construction emissions inventory, the user needs to start with identifying the project for which he/she wishes to calculate emissions. The fidelity of the emissions inventory is dependent on the information that the user has about the construction process necessary to complete the project. The user will consult the project categories (site/civil vs. vertical) to identify the project type that best represents the project.

2.4.1 Site/Civil Project Categories and Activity Data

The research team identified 24 site/civil project categories (not associated with construction of a building or structure). The 24 categories of projects and their associated activities can vary significantly relative to one another. Some projects, such as airfield lighting, have one listed construction activity, while others such as a cargo apron have more than 15 potential construction activities. Users will review the associated list of activities to ensure that the breadth of the project is represented in the list of activities. One user's single project may be represented by more than one default project types (in order to capture facets of the project) and their associated activities.

The default data used in ACEIT tend to include representative activities associated with the various project types. The 24 project types are as follows:

- | | |
|---------------------------------|------------------------------------|
| 1. Access Road | 13. Noise Barrier |
| 2. Airfield Lighting | 14. Parking Lot |
| 3. Cargo Apron | 15. Rehabilitate Runway or Taxiway |
| 4. Detention Basin | 16. Runway Drains |
| 5. Drainage System | 17. Runway Extension |
| 6. Fencing | 18. Runway Markings |
| 7. Fuel Tanks | 19. Runway Safety Area |
| 8. Hangar and Apron | 20. Service Road |
| 9. Helipad | 21. Taxiway Exit |
| 10. Landscaping | 22. Taxiways |
| 11. Navigational Aids (NAVAIDs) | 23. Terminal Apron |
| 12. New Runway | 24. Tiedowns |

For each of these project types, ACEIT incorporates default activities and construction equipment activity data (e.g., equipment mixes/times) that are scalable based on the project size. Users can modify the list of activities associated with each project type and can modify default ACEIT settings and data for each of the activities. Typical activities associated with the site/civil construction projects are as follows:

- | | |
|---------------------------|--------------------|
| a. Clearing/Grubbing | j. Street Lighting |
| b. Soil Erosion Control | k. Fencing |
| c. Topsoil Stripping | l. Hydroseeding |
| d. Cut/Filling Excavation | m. Marking |
| e. Subbase Placement | n. Sidewalks |
| f. Grading | o. Curbing |
| g. Asphalt Placement | p. Tree Planting |
| h. Concrete Placement | q. Dust Control |
| i. Drainage Piping | |

A specific construction equipment mix is associated with each of the above activities. For those projects and activities that are not specifically represented by one of these predefined items, a knowledgeable user can potentially modify the associated default equipment mix and usage times to reflect them.

2.4.2 Vertical Construction Projects and Activity Data

Activity data for vertical construction projects are based on structure categories (defined models) and structure area (ft²).

Predicting activity data for vertical construction projects can be complicated as there are many variables to consider including the size of the project, the schedule of the project, the various materials and systems that can constitute a building, and the different ways that a structure can be built. Vertical construction projects defined in this Guidebook include those structures with typical foundation systems, structural frames, and exterior sheathing respective of the size of the buildings. For this Guidebook and tool, the following 11 vertical project categories were identified:

1. Building 1 - 10,000 sqft - 1 story
2. Building 2 - 30,000 sqft - up to 3 stories
3. Building 3 - 100,000 sqft - up to 10 stories
4. Building 4 - 500,000 sqft - up to 20 stories
5. Carwash - 1,600 sqft - 1 story
6. Convenience Store - 1,200 sqft - 1 story
7. Fire Station - 20,000 sqft - 1 story
8. Gas Station - 1,400 sqft - 1 story
9. Hangar Building - 10,000 sqft - 1 story
10. Open Parking Lot @Grade - 10,000 sqft
11. Parking Structure 1 - 160,000 sqft - Grade +1 story
12. Parking Structure 2 - 240,000 sqft - Grade +2 stories
13. Site Work - 10,000 sqft

This list actually includes 13 items since the Open Parking Lot and the Site Work categories, which do not involve vertical structures, were included as part of vertical projects. In addition to these projects, the following demolition types are also included:

- Demolition – 10,000 sqft, 1 story Building
- Demolition – Concrete Pavement
- Demolition – Asphalt Pavement

As further defined in Appendix B, 55 vertical construction activities were identified for the above-referenced projects:

- | | |
|--|--|
| 1. Metal Panels | 28. Parapet Wall Construction |
| 2. 16 Ga. Heavy Metal Framing | 29. Pour Interior Slab on Grade |
| 3. 17 Ga. Heavy Metal Framing | 30. Pour Slab on Grade Floor |
| 4. 18 Ga. Heavy Metal Framing | 31. Pour Slab on Grade Floor & Slab on Metal Deck |
| 5. 19 Ga. Heavy Metal Framing | 32. Precast Concrete Exterior Panels |
| 6. Asphalt Pavement/Curbs | 33. Pre-Fab Canopies |
| 7. Asphalt Pavement-Ground Floor | 34. Pre-Fab Attendant Booth |
| 8. Binder Coat of Pavement | 35. Reinforced Masonry Shell |
| 9. Concrete Foundation Footings | 36. Remove Trees and Shrubs |
| 10. Concrete Foundations | 37. Roofing |
| 11. Concrete Post-Tensioned Frame | 38. Roofing-Standing Seam |
| 12. Construction Mob & Layout | 39. Rough Grading |
| 13. Curbing | 40. Security & Safety & Process Systems |
| 14. Erection of Pre-Engineered Metal Building | 41. Security & Safety Systems |
| 15. Exterior Wall Framing | 42. Set in-place Light Poles |
| 16. Exterior Wall Framing-Panel & Store-Front | 43. Site Clearing—Remove Trees & Shrubs |
| 17. Grub the Site Down 2 ft | 44. Site Prep/Landscaping |
| 18. Horizontal Deck Pours | 45. Site Restoration—Landscaping (Curbing) |
| 19. Install Ethylene Propylene Diene Monomer (EPDM) Roofing System | 46. Site Restoration—Landscaping (Top Soil Seed and Plantings) |
| 20. Install Equipment & Start-up | 47. Stripping |
| 21. Interior Build-Out/Finishes | 48. Structural Steel Erection |
| 22. Interior Build-Out/Finishes/Doors & Windows | 49. Structural Steel Erection & Decks |
| 23. Lighting Precast Concrete Piers (10) | 50. Structural Steel Frame |
| 24. Lights and Power | 51. Subgrade Materials Installed |
| 25. Masonry Wall 4 ft | 52. Top Coat of Asphalt |
| 26. Metal Joist/Floor & Roof Deck | 53. Underground Services & Tanks |
| 27. Metal Joist/Roof Deck/Ethylene Propylene Diene Monomer (EPDM) Roof | 54. Underground Conduits |
| | 55. Underground Services to 5 ft of Building |

Once users identify the basic dimensions of the project, they can either rely on default activities (which the tool scales to the project dimensions) or tailor the activities to the specific local condition. Similar to site/civil projects, users can employ default information in developing their emissions inventories with ACEIT, but the inventories can be improved through the use of more accurate user-supplied data.

2.5 Data Requirements and the Use of Defaults

In addition to the aforementioned emission factors and activity data, there are various other factors/variables that can influence the development of construction emissions inventories and improve the results. Based on lessons learned from various airport construction projects, other steps that the user could take to improve the data are as follows:

- Understand how the project will be constructed. Larger projects, such as building a taxiway, can be broken down into the various steps of the construction process, including site preparation

Key items to focus on in developing an airport construction emissions inventory:

1. Understand how the project will be constructed.
2. Understand any connected or enabling actions.
3. Understand the time period of construction.
4. Understand variances in how different contractors use equipment.
5. Understand the types of fuel used by each type of equipment.

(may require demolition and excavation), laying the base course, and placing concrete or asphalt. An understanding of how a project may be constructed can be achieved through discussion with project managers or engineers experienced with airport construction.

- Understand how the project will be constructed includes understanding other related and connected actions. For instance, if the primary project is extending a runway, there may be the need for a runway safety area, the relocation of NAVAIDs, and extension of any associated taxiways. Such sub-projects that enable the primary project vary from airport to airport, and thus, must be separately accounted for in each emissions evaluation. Default activities used in this Guidebook and tool may not capture the unique sub-projects or activities that may arise at an individual airport. Thus, discussions with the project managers or engineers should highlight any related project or activity to ensure they are adequately considered. Understand the time period of construction (which seasons/years and duration) as the emission factors for equipment will vary over time (based on the year[s] in which the construction activities occur). For instance, for funding reasons, a runway rehabilitation may be done in sections over several seasons and years, versus during a single construction season.
- Understand variances in how different contractors might deploy equipment during a project. For example, in a project requiring placement of fill, one contractor might use scrapers, whereas others may use loaders and excavators.
- Understand the types of fuel that may be used on project equipment. For instance, gas-powered generators may have relatively high CO emissions, whereas diesel generators may have relatively higher NO_x emissions.

The following sections briefly identify the minimum data requirements and how the user can improve the data used in the construction emissions inventory.

2.5.1 Minimum Data Requirements

In Chapter 3 of this Guidebook, reference is made to various levels of user input, as follows:

- The Level 1 input is basic input that includes minimal information (basic project dimensions and no activity data)
- Level 2 input is a refinement of the default data with improvements over the default
- Level 3 input includes comprehensive local construction practice base data supporting the construction activity data

This Guidebook and associated tool were developed with these various levels in mind. Because design has not been completed for projects that are being evaluated in the NEPA or Conformity processes, and contractors have not been selected to build the project, often little detailed construction information is available. FAA guidance notes that airport sponsors are limited in their actions on preparing more than 25% design prior to receiving NEPA approval (which requires completion of the Conformity requirements) [FAA Order 5050.4B, Paragraph 1004(c)]. Some users may only have basic project location and dimension information. Therefore, this section identifies the specific minimum data that the user must collect before using the Guidebook and tool.

Four specific types of data must be known/assembled about the project to use the Guidebook and ACEIT. Without this information, even default types of construction equipment and their use cannot be determined. However, users are cautioned to remember (and so note in their documentation) that use of the default information produces construction equipment exhaust and fugitive emissions using average assumptions.

The following minimum information must be provided by the user when using ACEIT:

- County where construction will occur (this is needed to narrow the emission factor information)
- Specific years when construction will occur, number of months, seasons associated with the construction duration, and daily average temperature ranges (this information narrows the emission factors and the calculation of hours of equipment use)
- Project type (from the list of site/civil and vertical listed previously in Section 2.4—this information is needed to identify default activities)
- Project size for each project type, as follows:
 - Length of the project (for roadways, runways, drainage, lighting, etc.)
 - Width of the project (for roadways, runways, taxiways, etc.)
 - Pavement type (asphalt versus concrete)
 - Area in square feet or acres (for aprons, parking lots, tiedowns, etc.)
 - Number of stories and ground floor area (vertical construction)

With the information above, the ACEIT tool can be used to develop a default level (Level 1) construction equipment activity data set and to calculate exhaust and fugitive emissions for each project. This emissions inventory would represent average national construction practices, and thus represents default data. The term default is used to refer to data that have been developed to allow users to create screening level construction inventories, when detailed data are not available. As such, default data generally represent a mixture of typical, average, and conservative information. Some conservatism is necessary as over-predictions are usually preferred when estimating emissions. However, as documented in the remaining sections of this chapter, guidance is provided on steps that the user can take to improve the use of defaults.

2.5.2 Resources to Improve Upon the Use of Defaults

There are many reasons that users may not wish to rely on default information. In general, the use of default data will tend to produce conservative results (i.e., overestimates). This is mainly due to the conservative data and assumptions used to develop the emission factors. As such, for General Conformity purposes, if the overall project emissions do not exceed the *de minimis* thresholds, then the user can feel confident that the project emissions are indeed under the thresholds. In contrast, if the emissions are above the thresholds, then further assessments can potentially be conducted with more accurate data (e.g., equipment activity information). Sponsors of large construction projects located in nonattainment areas will ideally invest in an engineering-level evaluation of the construction, within the parameters acceptable to the FAA. When the emissions inventory results exceed the applicable *de minimis* thresholds, users can refine the project construction information to ensure that the conservative nature of the defaults was not the sole reason that emissions would be above *de minimis*. However, smaller projects or projects in maintenance areas may not have the resources to conduct such evaluations. There are other steps that a user can take to improve the accuracy of the default assumptions. The following identify ways that users may be able to obtain more refined activity data (instead of relying on default data):

Ways to improve upon default data:

1. Know the overall details of the project.
2. Determine specific on-site equipment mix.
3. Develop hours-of-use for each project-specific piece of equipment.
4. Obtain more accurate off-site travel data.
5. If available, obtain project-specific fuel type for each piece of equipment.
6. Obtain more accurate temperature data.
7. Identify sources and data for fugitive emissions.

- **Select the overall needs and details of each project:** Knowing the project type and its size, ACEIT will provide a default level estimate of emissions associated with a project. The more informed user may have more details of the project and be able to better define the activities based on location, past projects, or other construction information. For the airport roadway

project example described earlier, sidewalks and fencing may not be necessary in all instances even though they are considered typical. Knowing this information, the user would delete these activities from the analysis. The ACEIT tool enables users to delete those activities that would not occur on the project.

Sources of information should be investigated to minimize project construction assumptions. A user with minimal information would use default activities, which would likely overestimate emissions associated with a project type. However, an informed user will know the expected site-specific construction activities that are required to implement the project and use those activities rather than defaults. Users can identify these refinements by gaining a better understanding of the construction practices of the area and the airport's conditions, which can be obtained through conversations with construction project managers and engineers.

- **Develop on-site construction equipment mix data corresponding to each construction activity:** Each construction activity for a project type will have a list of typical equipment used for that activity. In addition, certain construction activities are more likely to have fugitive emissions associated with them than others. The user should consider whether the equipment mix for a specific activity, provided as a default, would be representative of each construction activity. For example, typical excavation to construct a taxiway involves an excavator, dozer, roller, dump truck, pickup truck, and scraper. If a user knows that an excavator would not be used, that equipment can be removed from the calculations.

The list of equipment used by one contractor may be different than the equipment mix used by another contractor or an engineer. Therefore, it is advisable for the emissions estimator to coordinate with the project team to determine if the equipment selections are representative of local conditions and relevant to the required construction activities. While specific contractor equipment would not be known until the project is conducted (well after the FAA approves the action, design is initiated, the project is bid, and a contractor selected), the default equipment mix should always be reviewed in this fashion whenever resources allow.

- **Estimate project-specific hours of use for on-site equipment mix:** Construction equipment mix and operating hours will vary depending on the geographic location, soil characteristics, season of the year, and overall construction schedule. It is recommended that the user conduct some research on the expected hours of operation for the various pieces of equipment based on engineering specifications (i.e., will night construction be allowed and will weekend construction occur), local practices, and/or cost estimates. If such documents or resources are not available, default data and settings in ACEIT can be used to generate an inventory as an initial screening effort. As described previously, a user must have some basic information about the physical dimensions of projects, such as size (a 1,000 ft runway extension or a 10,000 ft² building), to perform emission calculations.
- **Identify reasonably foreseeable off-site travel-related data:** Emissions associated with off-site travel for material deliveries and employee travel must also be addressed in the construction emissions analysis. For example, the commute to work by the construction employees should be estimated based on available information about the expected number of construction workers, average travel distances, the speed limits of roads and thoroughfares leading to the airport, and distance to major suppliers of fill, subbase, concrete, asphalt, etc. The following information can be used to estimate such activities:
 - Number of construction employees (assume each individual as one commuter)
 - Employee commute distance
 - Distance to/from material supply depots (including fill, subbase, concrete, asphalt, and/or building materials)
 - Speed limit of thoroughfare or roads used for employee commute and those used to accommodate construction vehicle trips. Assume travel will be at the speed limit. This information can be used if trip duration is known rather than distances.

- Type of on-road vehicle(s) used by construction employees for work commute and used to make deliveries

As an example, the default information used in the ACEIT tool estimates employee work commute based on the cost of the project (to identify number of workers) and uses an average travel distance of 30 miles. Thus, the above list of project-specific data would improve upon the employee work commute estimates as well as various other activity-related data.

- **Determine fuel type:** ACEIT contains default emission factors for various equipment–fuel type combinations based on the county in which the project is located. The default fuel type (selection) for non-road equipment is diesel, which the user can change to gasoline. In either case, default emission factors are applied (whether for diesel or gasoline equipment). The user may also use more accurate fuel type and/or operating horsepower to derive more appropriate project-specific emission factors. The operating horsepower is a function of the equipment-rated horsepower and the load factor. Note that the rated horsepower is the maximum power rating for the equipment. The operating horsepower is defined as how much of the rated horsepower is being used, while the load factor represents the fractional use (e.g., a load factor of 0.5 equates to 50% of the rated horsepower). Therefore, the operating horsepower is derived by multiplying the rated horsepower by the load factor. A design consultant or contractor may be able to provide information on the horsepower (as the engine size/horsepower will affect the production rate of the piece of equipment) as well as fuel type for equipment typically used in the area. If more specific information is not available, the default average horsepower rating for each equipment type and the default diesel fuel type can be used.
- **Obtain more accurate temperature data for the airport:** The selection of emission factors is partly based on daily average ambient temperatures as well as average changes during the day. Therefore, the more historical the data that is used to develop these averages, the more confidence users will have in the emission factors. If resources allow, it is recommended that at least a year's worth of temperature data be analyzed, including differences by season.
- **Identify possible fugitive emissions:** Fugitive emissions are typically associated with the types of construction activities listed below:
 - Paint drying
 - Asphalt drying (paving)
 - Asphalt manufacturing and storage (batch plant)
 - Roof tar drying
 - Fuel transfer/storage
 - Unstabilized land
 - Soil handling
 - Concrete mixing and batching (batch plant)
 - Material movement (paved and unpaved roads)
 - Demolition
 - Conveying materials
 - Wind erosion (disturbed vacant lands, aggregate and sand piles, etc.)

Stabilized construction entrances, water suppression, or fabric filters on hot mix asphalt plants are some of the methods used to control fugitive emissions. It should be noted that specification of these controls will affect the selection of appropriate emission factors. Although default data are available for these types of emissions, any project-specific information would be helpful to more accurately determine if such emissions are occurring as well as their rates.

CHAPTER 3

Emissions Calculations and Inventory Development

3.1 Levels of Analysis

The availability of default emission factors and activity data in ACEIT provides the user with the ability to develop quick/screening level estimates of airport construction emissions. The default data also assist the modeling community in providing some consistency in the data used to calculate emissions. To use the default data, minimal project information is still necessary, including the defining of project type, size, and timing, as described in Section 2.5 of this Guidebook. However, users who have access to larger, more comprehensive construction information can elect to override the default data in ACEIT. To help differentiate the levels of data supplied by the user, the following definitions are provided:

- **Level 1:** The most basic level for which the user provides minimal project information and uses all of the default data
- **Level 2:** An intermediate level for which the user supplies some of the equipment activity data as refinements to the defaults supplied in ACEIT
- **Level 3:** The most detailed level for which the user is able to supply most or all of the equipment activity data as well as data to more accurately model fugitive emissions

Three levels of analysis differentiate the levels of data supplied by the user.

These definitions are not meant to be exact—they are provided as a general guide to better understand the level of data provided by each user. The purpose of this distinction is to reinforce that the Guidebook and tool's use can range from users with minimal information to those with comprehensive engineering-level or construction-process data. It is also possible that different subsets of a project (or program) may have different levels of detail available. In that case, the overall project may experience more than one of these defined levels. It is anticipated that most expert users will tend to conduct assessments at Level 2 or 3, supplying some or all activity data.

3.2 Airport Construction Emissions Data

This section provides a step-by-step set of instructions with examples of how airport construction emissions are calculated. The basis for these instructions is a database of both activity data and equipment emission factors that are used within ACEIT as defaults. The activity data (hours of use) were developed for each type of equipment based on expert engineering judgment and experience with airport construction projects, while the equipment emission factors were developed from the EPA's NONROAD and MOVES models. Further details of the underlying data and how they were developed can be found in the Final Report for this project.

Step-by-step explanations are provided on how to generate/obtain the information necessary to develop a construction emissions inventory.

To create a construction emissions inventory, the user needs to either create, or use the ACEIT tool to develop, the minimal project data/information shown as noted in Section 2.5.1 of this Guidebook. The following provides a step-by-step explanation of how to generate/obtain the information needed to develop an airport construction emissions inventory using this Guidebook and ACEIT. These steps are meant only to help explain what details to consider and how to obtain data in order to use ACEIT to calculate emissions. Further details on ACEIT can be found in Sections 3.3 to 3.5, including user's guide information and tutorials.

Step 1: Identify the Project and Any Sub-Projects/Activities

The user should start with identifying the major construction items for which they are preparing a construction emissions inventory. This begins with identifying those items that are listed in the 24 site/civil project types (as well as demolition options) or 11 vertical projects (as discussed in Section 2.4). If a project is not listed in one of these project categories, then the user has two options: 1) identify a project type that is similar in nature or 2) create a new project type. With the first approach, the user could tailor another project's activities to that of the desired project, which is likely the easier route. For example, the list of vertical projects does not include developing a snow shed on airport lands; a snow shed is not specifically called out in the list of buildings/vertical projects. In this example, a snow shed might be a 7,000 square feet single story structure. However, users could select "Building 1—10,000 ft², 1 story" to capture the snow shed building. Alternatively, the user could create a new project, but that approach would require the identification of the activities and equipment-use details. Then, the user should identify if sub-projects or activities are appropriately reflected in the default activities (see Section 2.4 or Appendix B). Some sub-projects may be listed as activities of the project type or may require inclusion of additional project types.

Then the user must identify the minimum information/size of the project, such as length and width of the runway extension or number of floors and ground floor acres/square foot space. This information is necessary to eventually establish the hours of usage of each piece of construction equipment.

Project Example:

The following project is used to identify how information might be improved:

- The airport is located in Seaside County, Florida.
- The project would be a 1,000-ft runway extension to a runway that is 200 ft wide.
- The runway is concrete and the extension will be concrete.

The proposed project is a runway extension, which is listed as project #17 in the site/civil listing of project categories. Upon investigation, the user found that the extension of the project would also require the relocation of various NAVAIDs, development of a new runway safety area, and extension of the parallel taxiway. These other enabling projects are not reflected in the default activities associated with site/civil project #17 (which would be known upon review of the activities associated with this project as listed in Appendix B), and thus need to be added as separate, sub-projects. In using ACEIT, the easiest way to do that is to separately represent in the overall project each of these sub-projects (versus the user directly adding activities to represent these sub-projects). On the list of site/civil projects, a runway extension would be site/civil project category #17, the safety area is project category #19, the NAVAID project category #11, and the taxiway extension project category #22. Each sub-project would require separate calculation of construction emissions to be captured in the overall emissions inventory.

Step 2: Identify the Minimum Data—Use All Defaults for Each Project Type

Section 2.5 of the Guidebook identifies the minimum information needed for each project type. This minimum dataset starts with identifying the county where the project is located. If the project spans multiple counties, the county with the greatest populace should be used, as the county is used to select the appropriate emission factors (based on fuel characteristics that are representative of each county).

Next, the user must identify the timeline of the construction activities since the emission factors vary by year and season. Seasonal variation in fuel characteristics is captured through the use of two seasons, as follows:

- Summer: May—October
- Winter: November—April

The overall length of the project would also impact the use of construction equipment and off-airport vehicle use. While equipment exhaust emissions are dependent on hours-of-use activity data, equipment evaporative emissions are dependent on the overall presence of the equipment at the construction site (e.g., overall length/duration of the project).

The location (airport) of the construction work is also important because of different fuel characteristics and ambient temperatures in different regions, both of which affect emission factors. Historical temperature data is readily available for most regions and can be used to estimate average temperatures.

Project Example:

Amending the details of the previously defined example project, the following information represents data collected up to this point for the specified project, as follows:

- The airport is located in Seaside County (fictitious county)
- The project is a 1,000-ft runway extension to a runway that is 200 ft wide
- The runway is concrete and the extension will be concrete
- Timeline: June 2015—October 2015
- Season: summer
- Daily average temperature during construction based on historic weather data: 82°F
- Daily average maximum and minimum temperatures: 71°F and 90°F

In this simple example, all construction occurs in just one year, but across two seasons. In this case, the user could model the full length of the project as one season (i.e., summer) as the area does not appear to experience significant seasonal changes. However, users may want to split the 5 months into summer and winter months to gain some further accuracy. This separation is prudent as the emission factors vary based on seasonal fuel use.

Also, in this example, it is assumed that no further details are known, including any insights that would allow deviations in the default activities and equipment that would be applied to the project. If this was the only information available, all default data would be used. However, if the user had access to other information, then the user might proceed to Step 3.

Step 3: Refine Activities for the Project

Each project type has a default set of project activities that are assumed to occur on each project. The user may have information indicating that one or more activity is not necessary for the project, or that some activity would be needed that is not represented in the activity list. Such a decision needs to be made for material types. Projects such as a runway extension require the user to determine whether the extension will be asphalt or concrete.

The default material choice reflected in ACEIT is asphalt, which the user can readily change as necessary.

Project Example:

Continuing with the runway extension project example, the following 17 activities (not in order of occurrence) are part of the default runway extension project:

- Asphalt placement
- Clearing and grubbing
- Concrete placement
- Drainage 24-inch smooth interior corrugated polyethylene pipe (SICPP)
- Drainage 6-inch perforated underdrain
- Dust control
- Excavation (borrow)
- Excavation (cut and fill)
- Excavation (topsoil stripping)
- Fencing
- Grading
- Hydroseeding
- Lighting
- Marking
- Soil erosion/control
- Subbase placement
- Topsoil placement

In this example, the user may know that the runway extension can be completed within the existing airport fence line, so the fencing activity can be deleted. However, the user might know that completion of this project would require a 100-ft² concrete pad to be removed before the site can be prepared. Therefore, the pad removal would need to be added to the project activities. This might consist of use of a dump truck and a loader for 4 hours each, and both of the equipment pieces might be diesel fueled. Since a specific pad removal project is currently not included in ACEIT, the user could choose a demolition option or select a suitable project where the associated activities and equipment can specifically be selected followed by the implementation of user-supplied activity data (hours of usage).

It should also be noted that for completeness, this list contains both Asphalt and Concrete Placements. Since only one of these choices should be used, the user will need to determine if the default asphalt selection is appropriate or if it needs to be changed to concrete.

Step 4: Identify Vehicle Fuel Types

One of the factors that affects the emissions associated with construction equipment is the type of fuel powering the equipment. Most often, this is diesel, but there are cases in which gasoline, LPG, CNG, and electric power vehicles may be used. The correct fuel type must be identified in order to apply the correct emission factors. This determination must also be made for on-road vehicles used for material deliveries as well as passenger travel to/from the work site(s). In ACEIT, only gasoline and diesel choices are provided to the user with the following defaults:

- Non-road construction equipment: diesel
- On-road material delivery vehicles: diesel
- On-road passenger vehicles: gasoline

Project Example:

For the runway extension example, the user assumes that the default fuel type (diesel) will be used by all construction vehicles, but knows that locally, contractors have invested in gasoline water trucks that are used for dust control. The user would accept defaults for all vehicles except for the dust control activity where the user would select gasoline. If the equipment had used a different fuel (e.g., CNG), the user could either select diesel or gasoline for screening purposes.

Step 5: Develop Activity Data

There are various activity data that influence emissions. The most significant are the hours of use for each construction equipment type. The default hours-of-use data are estimated based

on the overall project size information from which more detailed sizing information is deduced (e.g., land and material sizes). This sizing information is then used with activity rates to calculate equipment hours of use:

$$H = S \times AR$$

where, H = hours-of-use activity data

S = size (e.g., acre, yd³, etc.)

AR = equipment productivity activity rate (e.g., hrs per acre)

The user-supplied size information is used with the database of equipment productivity activity-rate data within ACEIT to calculate the default hours-of-use data. Rather than using these default hours-of-use data, more accurate estimates could potentially be obtained from engineers, project managers, equipment operators, etc. This activity data represents the duration of time over which construction equipment exhaust emissions occur. The Final Report provides details on all of the specific data and methods used to calculate activity data for each type of non-road and on-road equipment.

Project Example:

Continuing the runway extension example, the 1,000-ft runway extension (of a 200-ft wide runway) could translate to 4.6 acres of affected construction area. An average excavator can excavate 1,000 cubic yards of material per 8 hours. Assuming a depth of 1.25 feet, the total volume of material is estimated to be 9,259 cubic yards. Therefore, ACEIT would calculate the hours of usage as:

$$\begin{aligned} H &= 9,259 \text{ yd}^3 \times 8 \text{ hrs}/1,000 \text{ yd}^3 \\ &= 74 \text{ hrs} \end{aligned}$$

Thus, an excavator would require approximately 74 hours to complete the activity. Given that an average worker shift is 8 hours, this would translate to 9.25 person-shifts to complete the excavation work on this project activity. If the user found local data that indicates a different production rate (more or less cubic yards per hour of work), then the user can modify the hourly rates and or total project hours.

These hours-of-use estimates would need to be repeated for all of the associated activities and equipment. Again, more detailed examples can be found in the Final Report for this project.

Step 6: Define Parameters Affecting Equipment Emission Factors

The default construction equipment and on-road emission factors were developed from emissions inventory outputs from EPA's NONROAD and MOVES models. The emission factors incorporated into the ACEIT were developed based on the following categorizing factors:

- Year (2013–2043)
- Location (all U.S. states)
- Season
 - Summer: May–October
 - Winter: November–April
- Daily average temperature (T) (°F)
 - $T \leq 10$
 - $10 < T \leq 30$
 - $30 < T \leq 50$
 - $50 < T \leq 80$
 - $T > 80$

- Daily average maximum temperature change (°F)
 - $0 \leq \Delta T < 10$
 - $10 \leq \Delta T < 20$
 - $\Delta T \geq 20$
- Daily average minimum temperature change (°F)
 - $0 \leq \Delta T < 10$
 - $10 \leq \Delta T < 20$
 - $\Delta T \geq 20$
- Equipment Type (See Appendix B)
- Fuel Type
 - Diesel
 - Gasoline

These categorizing factors allow the user to indirectly define emission factors representative of project-specific scenarios. Emission factors for both exhaust and evaporative emissions are available.

Unlike these equipment exhaust and evaporative emission factors, other fugitive emission factors are developed from various equations as indicated in the Final Report for this project. These equations are used mainly to calculate VOC and PM emission factors from sources such as fuel transfer/storage, paint drying, wind erosion, etc.

Project Example:

Based on the example project specifications, the emission factors are based on the following categorizing factors:

- Year: 2015
- Location: Seaside County
- Season: summer
- Daily average temperature: 82°F
- Daily average maximum temperature: 90°F
- Daily average minimum temperature: 71°F
- Equipment type:
 - Default construction equipment (NONROAD equipment) selected based on construction activities specific to the project
 - Default on-road (MOVES) vehicles are light-duty, gasoline passenger cars for employee commute and heavy-duty, diesel long-haul trucks for material transport
- Fuel Type:
 - Default diesel for all non-road construction equipment
 - Default gasoline and diesel dependent on equipment type (see above)

The specified daily temperature information would equate to the following ranges:

- Daily average temperature: $T > 80^\circ\text{F}$
- Daily average maximum temperature change: $0^\circ\text{F} \leq \Delta T < 10^\circ\text{F}$
- Daily average minimum temperature change: $10^\circ\text{F} \leq \Delta T < 20^\circ\text{F}$

Based on these categorizing factors, the default equipment exhaust emission factors (based on the fictitious modeled scenario) for an excavator are:

- Diesel excavator (EF = emission factor)
 - $\text{CO EF}_{\text{Exhaust}} = 0.81 \text{ g/hp-hr}$
 - $\text{NO}_x \text{ EF}_{\text{Exhaust}} = 1.96 \text{ g/hp-hr}$
 - $\text{SO}_2 \text{ EF}_{\text{Exhaust}} = 0.0069 \text{ g/hp-hr}$
 - $\text{VOC EF}_{\text{Exhaust}} = 0.19 \text{ g/hp-hr}$

- $\text{PM}_{10} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.18 \text{ g/hp-hr}$
- $\text{PM}_{2.5} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.015 \text{ g/hp-hr}$
- $\text{CO}_2 \text{ EF}_{\text{Exhaust}} = 536 \text{ g/hp-hr}$

Such emission factors must be determined for each of the other construction equipment types. The PM emission factors (PM_{10} and $\text{PM}_{2.5}$) represent an aggregation of both exhaust and fugitive brake/tire wear emissions. The excavator evaporative emission factor is:

- Diesel excavator
 - $\text{VOC EF}_{\text{Evaporative}} = 0.1 \text{ g/equip-day}$

The relatively low VOC evaporative emission factor for diesel-based, non-road equipment (from NONROAD) is due to the fact that diesel fuel has relatively low vapor pressure and is not considered to evaporate under normal atmospheric conditions.

The corresponding default exhaust emission factors for a couple of on-road vehicles are:

- Gasoline passenger car
 - $\text{CO EF}_{\text{Exhaust}} = 2.80 \text{ g/mile}$
 - $\text{NO}_x \text{ EF}_{\text{Exhaust}} = 0.32 \text{ g/mile}$
 - $\text{SO}_2 \text{ EF}_{\text{Exhaust}} = 0.0062 \text{ g/mile}$
 - $\text{VOC EF}_{\text{Exhaust}} = 0.0024 \text{ g/mile}$
 - $\text{PM}_{10} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.0048 \text{ g/mile}$
 - $\text{PM}_{2.5} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.0044 \text{ g/mile}$
 - $\text{CO}_2 \text{ EF}_{\text{Exhaust}} = 422 \text{ g/mile}$
 - $\text{CH}_4 \text{ EF}_{\text{Exhaust}} = 0.127 \text{ g/mile}$
 - $\text{N}_2\text{O EF}_{\text{Exhaust}} = 0.0055 \text{ g/mile}$
- Diesel long-haul, asphalt 18 wheeler truck (material delivery)
 - $\text{CO EF}_{\text{Exhaust}} = 2.43 \text{ g/mile}$
 - $\text{NO}_x \text{ EF}_{\text{Exhaust}} = 7.14 \text{ g/mile}$
 - $\text{SO}_2 \text{ EF}_{\text{Exhaust}} = 0.0187 \text{ g/mile}$
 - $\text{VOC EF}_{\text{Exhaust}} = 0.0035 \text{ g/mile}$
 - $\text{PM}_{10} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.486 \text{ g/mile}$
 - $\text{PM}_{2.5} \text{ EF}_{\text{Exhaust + Fugitive}} = 0.471 \text{ g/mile}$
 - $\text{CO}_2 \text{ EF}_{\text{Exhaust}} = 2554 \text{ g/mile}$
 - $\text{CH}_4 \text{ EF}_{\text{Exhaust}} = 0.54 \text{ g/mile}$
 - $\text{N}_2\text{O EF}_{\text{Exhaust}} = 0.056 \text{ g/mile}$

The PM emission factors (PM_{10} and $\text{PM}_{2.5}$) represent an aggregation of both exhaust and fugitive brake/tire wear emissions (but do not include other fugitive emissions such as entrained dust). The on-road vehicle evaporative emission factors are:

- Gasoline passenger car
 - $\text{VOC EF}_{\text{Evaporative}} = 2.0 \text{ g/veh-day}$
- Diesel long-haul truck (material delivery)
 - $\text{VOC EF}_{\text{Evaporative}} = 0.5 \text{ g/veh-day}$

Similar to non-road equipment, the relatively low VOC evaporative emission factor for diesel-based, on-road equipment (from MOVES) is due to the fact that diesel fuel has relatively low vapor pressure and is not considered to evaporate under normal atmospheric conditions.

While all of these emission factors are based on the various specified parameters (e.g., temperatures, fuel type, etc.), the factors themselves are not directly modifiable by the user. They are only presented to the user for transparency purposes.

Step 7: Calculate Emissions for Each Activity

The calculation of exhaust emissions requires the data in all of the preceding steps. The calculations are required for each project, activity, equipment, and pollutant combination. As a result, manually calculating emissions is not considered feasible—all calculations should be handled using ACEIT. As previously indicated, the typical equation used to calculate construction equipment exhaust emissions, which is employed in ACEIT, is:

$$E = EF \times P \times LF \times A$$

- where, E = emissions (e.g., g)
- EF = emission factor (e.g., g/hp-hr)
- P = rated power (e.g., hp)
- LF = load factor (fraction)
- A = activity data (e.g., hours of use, hr)

In addition to these calculations, separate data and methods are necessary to calculate exhaust emissions from on-road vehicles, equipment/vehicle evaporative emissions, and fugitive emissions. As with the derivation of the activity data, detailed explanations of the data and methods (including assumptions) used for calculating each of the different emissions are presented in the Final Report for this project.

Project Example:

For the example case of the excavator being used on a runway extension project for the excavation activity (cut to fill), NO_x exhaust emissions are calculated as:

$$E = (1.96 \text{ g/hp-hr emission factor}) \times (50 \text{ hp power rating}) \times (0.6 \text{ load factor}) \times (74 \text{ hr of use})$$
$$= 4,351 \text{ g}$$
$$= 4.35 \text{ kg of NO}_x \text{ or } 0.0048 \text{ short tons of NO}_x \text{ for the excavator on one project activity}$$

ACEIT repeats these calculations for each of the other pollutants and other equipment types. Similarly, emissions for on-road vehicle activities, evaporation from equipment/vehicles, and fugitive sources are also calculated.

Step 8: Construct an Emissions Inventory

Once ACEIT calculates emissions for each project, activity, and equipment/vehicle combination, the complete set of emissions can be organized into the tabular structure as shown in Table 3-1.

This table shows total emissions for each pollutant for each year [for each year that the construction project(s) will occur], and it reflects all of the exhaust, evaporative, and other fugitive emissions during that period. These emissions can be combined with other project-level emissions for comparison to the General Conformity *de minimis* levels and for disclosure in NEPA-type documents.

While *ACRP Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Kim et al. 2009) suggests that when preparing GHG inventories, the user should report their

Table 3-1. Full construction emissions inventory structure (for each year of a given project).

Year	Total Emissions per Year								
	Short Tons						Metric Tons		
	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	VOC	CO ₂	CH ₄	N ₂ O
2015									
2016									
20xx									

GHG emissions as a CO₂ equivalent (CO_{2e}), that guidebook acknowledges that the Intergovernmental Panel on Climate Change (IPCC) has adopted several versions of global warming potentials (GWPs) that are used to convert non-CO₂ to a CO_{2e}. While *ACRP Report 11* recommends use of the most recent IPCC GWPs, the report notes that various reporting agencies may require different GWPs. Therefore, the ACEIT tool reports these individual pollutants, which users would then need to convert to CO_{2e} using their specific GWPs.

3.3 ACEIT Software Overview

The ACEIT uses a single-window graphical user interface (GUI) with a series of tabs that represent grouped options and data from which users can modify/input specific construction scenarios and data. Based on their content and order, the tabs represent a methodical series of steps that guides users on modeling scenarios.

Without the minimum information, ACEIT will **not** calculate an emissions inventory.

ACEIT was developed in concert with the default database of activity data and emission factors to support novice users with Level 1 input data, allowing for the quick development of airport construction emissions inventories, as well as the needs of more expert users with more specific input data. Expert users can override the default data with more project-specific information to develop more accurate emissions inventories.

ACEIT was developed with Microsoft .NET Windows-based software. As such, ACEIT only runs on computers running a Windows-based operating system. All recent versions of Windows (available at the time of this Guidebook's release) should be able to run ACEIT, including Windows XP, Vista, Windows 7, and Windows 8. Resource requirements (e.g., speed, memory, etc.) are relatively modest, but the research team recommends that computers with at least 4GB of random access memory (RAM) be used; otherwise, users may experience some sluggishness. In order to use ACEIT, it must first be installed using the supplied installation package.

As previously indicated, notes on each tab (at the bottom of the input screens) provide guidance and hints on maximizing the features on each respective tab. Many of these notes are repeated from tab to tab for the user's benefit and to highlight the tabs' common features. For example, one note reminds the user that only cells highlighted in light blue are modifiable by the user.

Each of the table columns can be widened to show more information by clicking and dragging the column divider/borders in the header of each table. Also, horizontal and vertical slider bars (if available at the bottom or right of each window) can be used to scroll through tables to reveal additional columns and rows. The number of cells and rows that are visible is dependent on the version of Windows being used and the resolution of the user's computer monitor.

On the first screen, the user is asked to name the study. Structurewise, a "study" represents all of the items and situations that will be investigated using the tool; in essence, a study is the user's individual project or a group of projects for which an emissions inventory is sought. Users can complete only one study at a time. Within a study, the user must select an airport location for which various scenarios can be defined. Then, each scenario is defined by seasons, temperatures, projects, activities, and equipment. This hierarchy is displayed below:

A "study" is defined as an inventory for an individual project or group of projects.

- Study
 - Airport location definition
 - Scenario definition—scenarios can be projects or construction styles for a single project, as emissions are reported by scenario
 - Seasons and temperatures
 - Projects, activities, and equipment

When a study is saved to an external file, all of the specific definitions, including project, activity, and equipment specifications, as well as any user-supplied data, are saved. As such, it is recommended that before making any changes to the default data, the user should save the study. While ACEIT's interface allows modifications to the default data, there is no undo feature.

3.4 ACEIT Software Features and Functionality

The ACEIT tool opens with the following tabs being visible:

1. Setup (minimum requirement)
2. Project (minimum requirement)
3. Overall Size (minimum requirement)
4. Size Details (allows refinement to detailed size and activity data)
5. Activity: Non-Road (allows refinement specific to the non-road activity data)
6. Activity: On-Road (allows refinement specific to the on-road activity data)
7. Emission Factors: Non-Road (non-modifiable emission factors for non-road equipment)
8. Emission Factors: On-Road (non-modifiable emission factors for on-road equipment)
9. Fugitive (allows refinement to fugitive emissions activity and calculations)

Once users have input the data appropriate to their study, there is a button at the bottom right that allows for information to be saved and for the calculation of the emissions inventory.

The following sections provide instructions on how to use ACEIT. The sections are organized according to the tabs in the tool starting with the Setup tab. The focus of these instructions is to describe and clarify the functionality of the tool, including how to input data, select options, the purpose of each button, and so forth.

The tabs are organized such that the first three tabs (Setup, Project, and Overall Size) represent the minimal information required from the user. *Without this information, the tool will not calculate emissions.* Appendix C provides a reiteration of the minimum data requirements including a full list of the requirements for Overall Size data by project type.

Also, data must be supplied to these tabs in the order indicated (i.e., Setup first, Project second, and Overall Size third). The rest of the tabs (starting with Size Details) provide default data (e.g., activity data) that the user can modify/replace with more project-specific data in order to obtain more accurate results. The rest of the tabs also provide emission factors data that are not modifiable by the user.

3.4.1 Setup (Minimum Required Data)

As shown in Figure 3-1, the Setup tab is the first view (after the title screen) presented to the user when ACEIT is launched. When ACEIT is started with the title screen presented, the underlying default data is loaded into memory just before this Setup tab is presented. This is the first of the three tabs that requires minimum information from the user; without this information, ACEIT cannot generate emissions. The functionality of each of the features on this tab is described below:

Study Name (text box). Name of the study up to 28 characters in length to be specified by the user to help identify the purpose or goal of the study.

Description (text box). Text (unlimited length) specified by the user to provide further details of the study. Users are encouraged to be as descriptive as possible in order to provide information that in the future will serve as a reminder to the purpose and focus of the study.

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

1 2 3 <----- Please fill out the first three (3) tabs in the order shown

Minimum Data Required from User

Study Name: Test Project

Description: This is a test project for demonstration purposes only.

State: Indiana

County: Brown County

DISCLAIMER

While allowing users to quickly and consistently develop airport construction emissions inventories, the Airport Construction Emissions Inventory Tool (ACEIT) should only be used for planning purposes including General Conformity. It should not be used for non-airport work including transportation conformity evaluations or transportation conformity state implementation plans.

NOTES

1. The Guidebook contains a User's Guide for ACEIT.
2. At a minimum, the user needs to provide data for the first three tabs (Setup, Project, and Overall Size - in that order). The other tabs provide default data that can be modified or replaced with more accurate data supplied by the user. A checklist of minimum information requirements is provided in the appendices of the Guidebook.
3. Press the "Apply" button after entering new data or making edits.
4. Once the scenarios have been defined within the first three tabs, press the Run button to calculate emissions and develop inventories.

Scenarios:

	Scenario ID	Year	Number of Months	Season	Average Daily Temp (degF)	Max Daily Temp Change (degF)	Min Daily Temp Change (degF)
▶	1	2015	4	Summer	> 80	0 ≤ Change in T < 10	10 ≤ Change in T < 20
*	2						

Help: Scenario Guidance

Apply

Run View Results

Figure 3-1. Setup tab.

State (drop-down list). A drop-down menu listing all of the U.S. states, one of which must be selected by the user to specify the location of the study (e.g., where the airport is located). The choice of location provides specificity to fuel characteristics (i.e., different regions have different fuel qualities), which affect emission factors.

County (drop-down list). A drop-down menu listing all of the counties available within the chosen state, once the state is selected. Along with the state, the selection of the county provides further specificity to fuel characteristics (i.e., different regions have different fuel qualities), which affect emission factors.

Scenarios (table). This table allows for the setup of all project scenarios to be included in the study. Each row corresponds to a scenario and is automatically given an identification (ID) number in the leftmost column.

The purpose of the scenario is to enable the user to separate emissions activities by seasons. Users may not have seasonal information, and if only inputting one season, users should select the season during which the dominant activity will occur, which is usually summer.

In other cases, the user may wish to use scenarios to separate components of the project. Scenarios might be used if a project included unique construction activities for which emissions needed to be determined, or the default project categories did not capture facets of the project and either a user-defined project was being input or a second project category was being added to the primary project category. For instance, if the runway extension example would include development of a new runway safety area, the user might wish to have separate scenarios/IDs for the runway extension versus the runway safety area.

The user must specify the year of the construction scenario from 2013 to 2043 using the available drop-down list. Similarly, the user must specify the number of months (1–12) from the drop-down menu to indicate the overall duration of the project for the selected year. From the season drop-down list, the user must select either summer or winter as indicated below:

- Summer: May–October
- Winter: November–April

This specification is necessary since season affects fuel characteristics, which affect emission factors. As such, if the number of months (duration) of a scenario does not fall completely into either the summer or winter definitions above, then two (or more) scenarios can be created to separate the months accordingly into both summer and winter periods (i.e., both scenarios would be based on the same year). If the user is not certain of the timing, then a single season can be chosen. In addition, a project with noncontiguous parts can also be modeled accordingly based on the selection of year and season (e.g., 3 months in summer 2017 and 2 months in summer 2018).

The last three rightmost rows of this tab ask the user to select from temperature ranges to specify the average daily temperature, the maximum daily temperature, and the minimum daily temperature. Temperature is noted in Fahrenheit. The maximum and minimum temperatures are specified as changes from the average daily temperature. To better understand the impacts of temperatures, seasons, etc., this project's Final Report provides some indications. In addition, users are encouraged to review the various supporting technical documents for EPA's NONROAD (<http://www.epa.gov/oms/nonrdmdl.htm>) and MOVES (<http://www.epa.gov/otaq/models/moves/index.htm>) models.

The scenario IDs are automatically generated as the user chooses the year, season, etc. These IDs are used to identify each scenario and differentiate each set of activity data, emission factors, and calculated emissions.

The Apply button only saves any new or modified data to temporary memory in defining the current scenario. It does not save any data to an external file.

Help: Scenario Guidance (button). Opens a pdf file providing specific guidance on how to set up scenarios in the table.

Apply (button). Once all of the necessary data has been entered/selected on this tab, the Apply button must be pressed to implement the information. After the button is pressed and the data has been implemented, a pop-up window will appear indicating the data has been “saved” and to move onto the next tab. This action only saves the data to temporary memory in defining the current scenario (it does not save the data into an external file).

3.4.2 Project (Minimum Required Data)

The Project tab, as shown in Figure 3-2, allows users to specify the projects, construction activity, and equipment for each modeled scenario. This is the second of the three tabs that require minimum information from the user; otherwise, ACEIT will not generate emissions calculations. In each of the project, activity, and equipment lists, multiple selections can be made

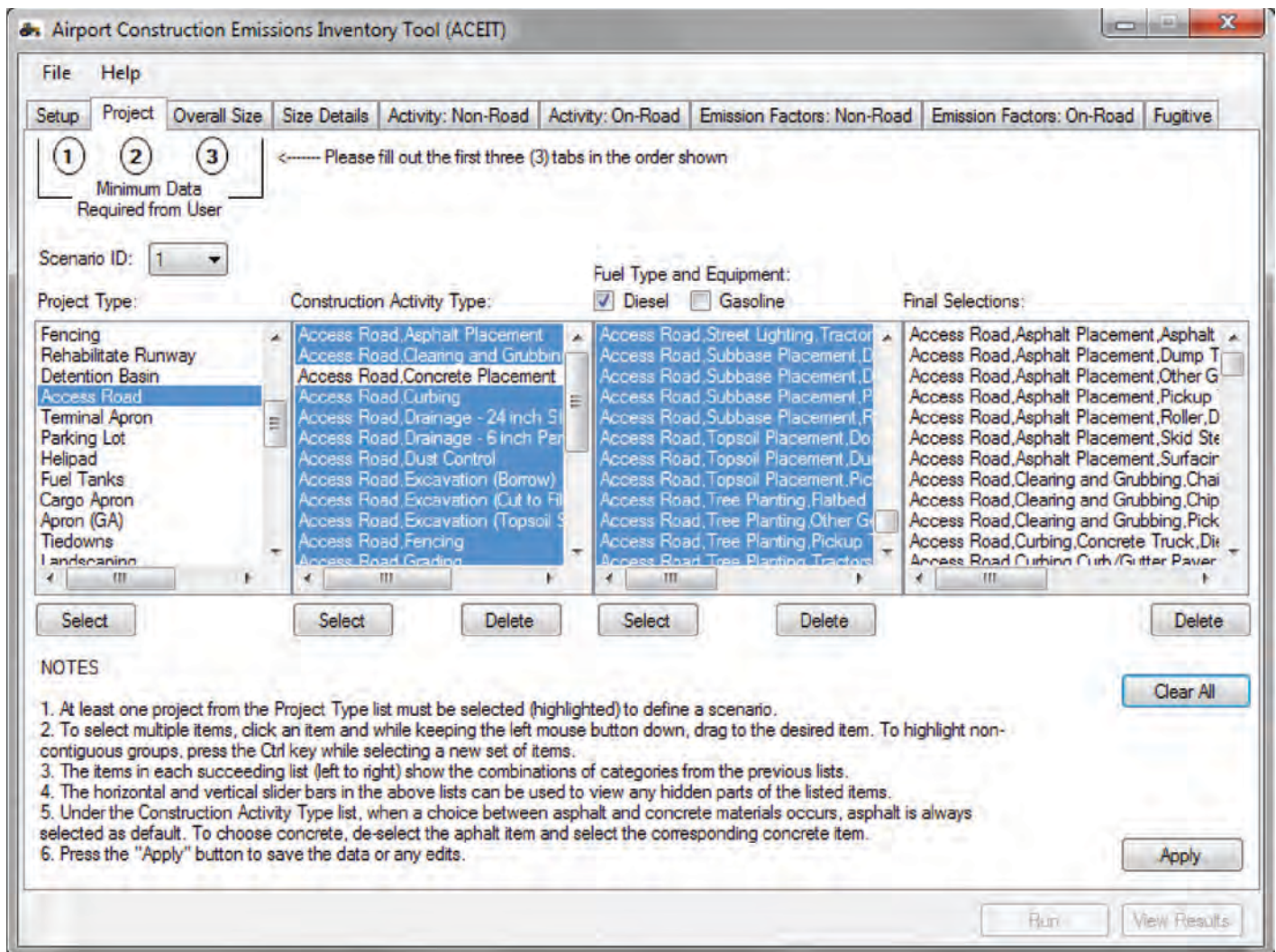


Figure 3-2. Project tab.

by clicking on the items while holding the shift or control (Ctrl) key (or the mouse key). The shift key will allow the highlighting of multiple contiguous items (all those between an already highlighted item and a new item). Pressing and holding down the mouse button while dragging the mouse also has the same effect. In contrast, the control key will allow the selection of both contiguous and noncontiguous items but only one at a time.

Progressing from left to right, each list becomes populated with items that correspond to the selections (highlights) made in the previous list. The selections are additive (i.e., as opposed to an either/or functionality) where subsequent selections from one list are added progressively to the next list rather than being replaced by the latest selection. It should also be noted that duplicates are not allowed. That is, once a selection has been made, the same item cannot again be selected—each item in each list is unique.

Scenario ID (drop-down list)

The scenarios previously defined under the Setup tab are reflected in this drop-down list of Scenario ID numbers. Therefore, the user can select the specific scenario to define the projects, activities, and equipment.

Project Type (list)

This column lists all of the default project categories available for modeling in the tool. The user can select one or more projects for inclusion in the project. Selections are made by clicking and highlighting the desired project(s). Appendix B, Table B-1 identifies the site/civil and vertical/building categories that are default in ACEIT.

Select (button under the Project Category list)

Pressing this button will populate the Construction Activity Type column with the activity types that correspond to the selected project(s).

Construction Activity Type (list). All default activity types corresponding to the highlighted project types are listed in this column once the previous select button is pressed. The listing preserves the relationship between Project Type and Construction Activity Type using the following format:

Project Type.Construction Activity Type

The user must select one or more activities for inclusion in the project. Selections are made by clicking and highlighting the desired activity(ies). By default, all items in this list are highlighted except when a choice between concrete or asphalt occurs. Although both of these material choices are included in the list, only the asphalt choice is initially highlighted as default. The user can readily change this choice if necessary by de-highlighting the asphalt item and highlighting the concrete item.

Select (button under the Construction Activity Type list). Pressing this button populates the Fuel Type and Equipment list with the equipment types that correspond to the selected activity(ies).

Delete (button under the Construction Activity Type list). Deletes any highlighted items in the Construction Activity Type list.

Fuel Type and Equipment (list). This column lists all of the default equipment once the Select Activity button is pressed. The listing shows the relationship between Project Type, Construction Activity Type, and Equipment in the form:

Project Type.Construction Activity Type.Equipment

The user must select one or more equipment types for inclusion in the project. Selections are made by clicking and highlighting the desired equipment.

Diesel (check mark option above the Fuel Type and Equipment list). The user must either select this option or the gasoline option to indicate the fuel type for the selected equipment.

Gasoline (check mark option above the Fuel Type and Equipment list). The user must either select this option or the diesel option to indicate the fuel type for the selected equipment.

Select (button under the Fuel Type and Equipment list). When this button is pressed, the last, rightmost column (Final Selections) will be populated with the selections made in the Fuel Type and Equipment column taking into account the diesel or gasoline fuel type option that was selected.

Delete (button under the Fuel Type and Equipment list). Deletes any highlighted items in the Fuel Type and Equipment list.

Final Selections. This column is populated with a listing of the selections from the Fuel Type and Equipment column once the Select button under the Fuel Type and Equipment list is

pressed. The listing shows the relationship between Project Type, Construction Activity Type, Equipment, and Fuel Type in the form:

Project Type. Construction Activity Type. Equipment. Fuel Type

All of the items in this list represent the final selections that will be included in the study (they do not need to be highlighted). For calculation purposes, the listed items in the other (previous) columns are irrelevant as only the items in this Final Selections list will be used.

Delete (button under the Final Selections list). This button is used to delete items from the Final Selections list, allowing the user to further customize each scenario. Only the selected (highlighted) items are deleted.

Clear All (button). This button clears all of the listing and selections within the Construction Activity, Fuel Type and Equipment, and Final Selections lists. It essentially allows the user to start all over on this tab.

Apply (button). Pressing this button will implement the items in the Final Selections list. That is, the items will be used in the study with corresponding data shown in subsequent tabs. After the button is pressed and the data has been saved, a pop-up window will appear indicating the data has been saved and to move onto the next tab.

3.4.3 Overall Size (Minimum Required Data)

As shown in Figure 3-3, this is the tab on which users will enter the overall project sizing information necessary for ACEIT to ultimately derive activity data (e.g., hours of use). This is the third of the three tabs that requires data from the user. As the tab name implies, the size questions asked are minimal and pertain to the overall project (i.e., as opposed to the detailed activities or equipment associated with the project). Examples of the types of information requested include the overall cost, width and length of the project, number of trees, etc. While most of these requests are similar for many projects, the answers must be specific to each project. For studies involving multiple scenarios of the same project (e.g., covering different time periods of the same project), the same overall size information should be used for each scenario. The information should only be different if the multiple scenarios each pertain to different projects.

Apply (button). Pressing this button will implement all of the size-related data provided by the user in this tab. After the button is pressed, a pop-up window will appear indicating the data has been saved and to move onto the next tab.

3.4.4 Size Details

As presented in Figure 3-4, the user can enter detailed size-related data associated with the specific project. ACEIT uses information obtained in the prior Overall Size tab and default size data to narrow the specific information that would be needed for the specific project under study. These default data are specific to the construction activities associated with each project and they reflect the internal engineering formulations and assumptions used to derive such details. The user can choose to modify/replace any of the blue-highlighted values in the Activity Size column with more accurate information if available.

Apply (button). Pressing this button will save and implement any changes made to the default size data. After the button is pressed, a pop-up window will appear indicating the data has been saved.

File Help

Setup Project **Overall Size** Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

1 2 3 <----- Please fill out the first three (3) tabs in the order shown

Minimum Data Required from User

	Scenario ID	Project	Project Size Question	User Input	Unit
1	1	Access Road	What is the estimated cost of the project?	75	\$ Million(s)
2	1	Access Road	What is the maximum length of the road (L) in feet?	2000	Feet
3	1	Access Road	What is the maximum width of the road including shoulder (W) in feet?	40	Feet

NOTES

1. This is the minimal set of overall project size and characteristics data necessary to model each scenario.
2. Only the data in the blue highlighted cells may be modified by the user.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns and rows.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. The overall cost of the project is necessary to estimate the number of workers to calculate total travel from home to work and vice versa.
6. The overall size data should be specific to each scenario (e.g., the cost value is specific to each scenario).
7. Press the "Apply" button to save the data or any edits.
8. Once the scenarios have been defined within the first three tabs, press the Run button to calculate emissions and develop inventories.

Apply

Run View Results

Figure 3-3. Overall Size tab.

3.4.5 Activity: Non-Road

As illustrated in Figure 3-5, all of the construction equipment (non-road equipment) default activity data (i.e., hours of use) is presented. Initially, the information listed in this tab represents default information associated with the information input in the prior tabs. Users can then alter the activity data if they have site- and project-specific uses.

The activity data was calculated from the activity size values from the previous Size Details tab, which is also reproduced in this table for reference purposes. This default data is organized according to the Scenario ID, Project, Construction Activity, and Equipment types previously selected. The user can either use this default data or modify them on this sheet if more accurate data is available. Only the blue-highlighted values in the Activity Data column can be modified.

Create Non-Road Activity Data List (button). Pressing this button will allow a facsimile of this table to be saved into an external comma-delimited ASCII text file. The user will be presented with a dialogue box to indicate where to save the file. This is a convenience provided to the user in that the external file can be handed to engineers, manufacturers, etc. who may be able to provide more accurate activity data.

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size **Size Details** Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Construction Activity	Activity Size	Unit
1	1	Access Road	Asphalt Placement	8,880.00	Square Yards
2	1	Access Road	Clearing and Grubbing	2.30	Acres
3	1	Access Road	Curbing	4,000.00	Linear Feet
4	1	Access Road	Drainage - 24 inch SICPP	2,010.00	Linear Feet
5	1	Access Road	Drainage - 6 inch Perforated U...	4,020.00	Linear Feet
6	1	Access Road	Dust Control	120.00	Days
7	1	Access Road	Excavation (Borrow)	3,700.00	Cubic Yards
8	1	Access Road	Excavation (Cut to Fill)	3,700.00	Cubic Yards
9	1	Access Road	Excavation (Topsoil Stripping)	8,880.00	Square Yards
10	1	Access Road	Fencing	2,000.00	Linear Feet
11	1	Access Road	Grading	11,155.50	Square Yards
12	1	Access Road	Hydroseeding	100,500.00	Square Feet

NOTES

1. This is the default size data associated with each project's activity type.
2. Only the data in the blue highlighted cells may be modified by the user.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns or rows.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. For vertical construction projects (e.g., buildings), no size details are provided because the sizes are predefined as part of the selected project (e.g., 10,000 sq. ft., 1-story building).
6. Press the "Apply" button to save any edits.

Apply Run View Results

Figure 3-4. Size Details tab.

Apply (button). Pressing this button will save and implement any changes made to the default activity data. After the button is pressed, a pop-up window will appear indicating the data has been saved.

3.4.6 Activity: On-Road

As shown in Figure 3-6, all of the on-road (material deliveries and employee travel) default activity data [i.e., vehicle miles traveled (VMT)] is presented. The activity data was calculated from the information in the previous tabs and reflects various engineering and planning estimates and assumptions. This default data is organized according to the Project and Equipment types previously selected. The user can either use this default data or modify them on this sheet if more accurate data is available. The blue-highlighted values in the VMT column are modifiable and the selections in all of the other columns can be changed as well. This allows the user to specify the equipment, fuel type, and roadway type for each project and scenario.

Only the Scenario IDs and Projects that have been defined in the previous tabs are available in the drop-down lists. The Equipment drop-down list provides a list of on-road vehicles

Airport Construction Emission Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details **Activity: Non-Road** Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Construction Activity	Equipment	Fuel Type	Activity Size	Activity Rate	Activity Data	Activity Unit
1	1	Access Road	Asphalt Pla...	Asphalt Paver	Diesel	8,880.00 SY	8 Hours per 6,400 SY	11.1	hours
2	1	Access Road	Asphalt Pla...	Dump Truck	Diesel	8,880.00 SY	8 Hours per 1,777 SY	40.0	hours
3	1	Access Road	Asphalt Pla...	Other Gener...	Diesel	8,880.00 SY	16 Hours per 6,400 SY	22.2	hours
4	1	Access Road	Asphalt Pla...	Pickup Truck	Diesel	8,880.00 SY	8 Hours per 6,400 SY	11.1	hours
5	1	Access Road	Asphalt Pla...	Roller	Diesel	8,880.00 SY	8 Hours per 6,400 SY	11.1	hours
6	1	Access Road	Asphalt Pla...	Skid Steer L...	Diesel	8,880.00 SY	8 Hours per 6,400 SY	11.1	hours
7	1	Access Road	Asphalt Pla...	Surfacing E...	Diesel	8,880.00 SY	8 Hours per 5,000 SY	14.2	hours
8	1	Access Road	Clearing an...	Chain Saw	Diesel	2.30 Acre	12 Hours per 1 Acre	27.6	hours
9	1	Access Road	Clearing an...	Chipper/Stu...	Diesel	2.30 Acre	12 Hours per 1 Acre	27.6	hours
10	1	Access Road	Clearing an...	Pickup Truck	Diesel	2.30 Acre	16 Hours per 1 Acre	36.8	hours
11	1	Access Road	Curbing	Concrete Tr...	Diesel	4,000.00 LF	8 Hours per 400 LF	80.0	hours

NOTES

1. This is the non-road equipment default activity data of the defined scenario(s).
2. Only the data in the blue highlighted cells may be modified by the user.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns or rows.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. Press the "Apply" button to save any edits.

Create Non-Road Activity Data List Apply

Run View Results

Figure 3-5. Activity: Non-Road tab.

typical for material deliveries and employee travel (i.e., home to work and vice versa). The Fuel drop-down list provides a choice of diesel or gasoline, and the Roadway list provides a choice of different rural, urban, and off-network types (the same choices available in MOVES). In addition to modifying any of these default settings and data, the user can also specify additional vehicle activities by adding additional records to the table.

Create On-Road Activity Data List (button). Pressing this button will allow a facsimile of this table to be saved into an external comma-delimited ASCII text file. The user will be presented with a dialogue box to indicate where to save the file. This is a convenience provided to the user in that the external file can be handed to engineers, manufacturers, etc. who may be able to provide more accurate activity data.

Apply (button). Pressing this button will save and implement any changes made to the default activity data. After the button is pressed, a pop-up window will appear indicating the data has been saved.

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road **Activity: On-Road** Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Equipment	On-road Activity	Fuel	Roadway	VMT
▶ 1	1	Access Road	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	1,161
2	1	Access Road	Dump Truck - Asphalt	Material Delivery	Diesel	Urban Unrestricted Access	1,644
3	1	Access Road	Dump Truck Subbase ...	Material Delivery	Diesel	Urban Unrestricted Access	9,867
4	1	Access Road	Passenger Car	Employee Com...	Gasoline	Urban Unrestricted Access	2,128,500
* 5							

NOTES

1. This is the on-road equipment default activity data of the defined scenario(s).
2. Only the data in the blue highlighted cells may be modified by the user, but the other fields allow modifications to redefine equipment types, fuel types, etc.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. Press the "Apply" button to save any edits.
6. Each row can be deleted by clicking the row in the left-most column of the table, and then pressing the delete button.
7. If an existing Scenario ID is changed, the user must also select the appropriate corresponding Project type when there is more than one Project type modeled for a scenario.

Create On-Road Activity Data List Apply

Run View Results

Figure 3-6. Activity: On-Road tab.

3.4.7 Emission Factors: Non-Road

The tab displayed in Figure 3-7 presents all of the default emission factors for each of the types of construction equipment (non-road equipment) selected for this study. The horsepower, load factor, and emission factors are organized by Scenario ID, Project, Construction Activity, Equipment, and Fuel Type. The data is not modifiable by the user and is presented for transparency.

Most of the emission factors have units of g/hp-hr. As such, emissions are dependent on the horsepower rating, load factor, and hours of usage of each piece of equipment. In contrast, the average, evaporative VOC emission factors have units of g/equip-day where the emissions are based on the number of days the equipment is located on the construction site.

3.4.8 Emission Factors: On-Road

As shown in Figure 3-8, this tab provides all of the default emission factors (g/mi and g/veh-day) for each type of on-road vehicles used in the study. The data is organized by Scenario

Airport Construction Emission Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Construction Activity	Equipment	Fuel Type	Avg Rated HP	Load Factor	CO (g/hp-hr)	NOx (g/hp-hr)	CO2 (g/hp-hr)	SO2 (g/hp-hr)	PM (g/hp-hr)
1	1	Access Road	Asphalt Pla...	Asphalt Paver	Diesel	175	0.590	0.9396...	2.3441...	536.16...	0.0070...	0.017...
2	1	Access Road	Asphalt Pla...	Dump Truck	Diesel	600	0.590	0.6704...	1.7269...	536.35...	0.0066...	0.008...
3	1	Access Road	Asphalt Pla...	Other Gener...	Diesel	175	0.430	0.7093...	2.8323...	530.31...	0.0071...	0.014...
4	1	Access Road	Asphalt Pla...	Pickup Truck	Diesel	600	0.590	0.6704...	1.7269...	536.35...	0.0066...	0.008...
5	1	Access Road	Asphalt Pla...	Roller	Diesel	100	0.590	2.6319...	2.9064...	595.31...	0.0079...	0.028...
6	1	Access Road	Asphalt Pla...	Skid Steer L...	Diesel	75	0.210	5.9753...	5.5389...	692.25...	0.0097...	0.072...
7	1	Access Road	Asphalt Pla...	Surfacing E...	Diesel	25	0.590	2.6170...	4.4597...	594.67...	0.0086...	0.029...
8	1	Access Road	Clearing an...	Chain Saw	Diesel	11	0.700	293.53...	1.3229...	685.99...	0.1401...	0.779...
9	1	Access Road	Clearing an...	Chipper/Stu...	Diesel	100	0.430	2.3822...	4.3247...	588.88...	0.0081...	0.034...
10	1	Access Road	Clearing an...	Pickup Truck	Diesel	600	0.590	0.6704...	1.7269...	536.35...	0.0066...	0.008...
11	1	Access Road	Curbing	Concrete Tr...	Diesel	600	0.590	0.6704...	1.7269...	536.35...	0.0066...	0.008...
12	1	Access Road	Curbing	Curb/Gutter...	Diesel	175	0.590	0.9396...	2.3441...	536.16...	0.0070...	0.017...

NOTES

1. These are the default emission factors associated with the non-road equipment specific to the defined scenario(s). They are not modifiable by the user, and are presented for display purposes only.
2. The emission factors were developed from the USEPA's NONROAD.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns or rows.
4. The width of each column can be increased or decreased by dragging the column's borders.

Run View Results

Figure 3-7. Emission Factors: Non-Road tab.

ID, Project Type, Equipment, Fuel Type, and Roadway Type, mimicking most of the same columns in the Activity: On-Road tab. The data is not modifiable by the user and is presented for transparency.

The exhaust emission factors have units of g/mile and encompass fugitive tire and brake wear emissions. Therefore, exhaust emissions are based on VMT estimates (i.e., the default estimates presented in the Activity: On-Road tab). These are the “rate per distance” emission factors derived from MOVES. In contrast, the emission factors having units of g/veh-day are either “rate per vehicle” (RV) or “rate per profile” (RP), also derived from MOVES. Example RV and RP emissions are “crankcase start exhaust” and “evap fuel vapor venting,” respectively.

3.4.9 Fugitive

As presented in Figure 3-9, all of the default data and formulations necessary to derive fugitive emissions are presented in this tab. The Fugitive Types (sources) are categorized according to the Scenario ID, Project, and Construction Activity. Then each Fugitive Type is organized with the variables listed first (the variable definitions and their values) followed by the equation used to

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road **Emission Factors: On-Road** Fugitive

	Scenario ID	Project Type	Equipment	Fuel Type	Roadway Type	CO (g/mi)	NOx (g/mi)	CO2 (g/mi)	SO2 (g/mi)	PM10 (g/mi)	PM2.5 (g/mi)	CH4 (g/mi)
▶ 1	1	Access Road	Asphalt 18 ...	Diesel	Urban Unr...	2.4333...	7.6244...	2468.1...	0.0181...	0.4856...	0.4710...	0.5409...
2	1	Access Road	Dump Truc...	Diesel	Urban Unr...	1.4211...	3.2961...	1347.0...	0.0097...	0.1748...	0.1696...	0.4241...
3	1	Access Road	Dump Truc...	Diesel	Urban Unr...	1.4211...	3.2961...	1347.0...	0.0097...	0.1748...	0.1696...	0.4241...
4	1	Access Road	Passenger ...	Gasoline	Urban Unr...	2.6229...	0.3071...	405.49...	0.0061...	0.0050...	0.0046...	0.1270...

NOTES

1. These are the default emission factors associated with the on-road equipment specific to the defined scenario(s). They are not modifiable by the user, and are presented for display purposes only.
2. The emission factors were developed from the USEPA's MOVES. The "g/mi" exhaust emission factors are based on MOVES "rate per distance" factors. The RV and RP (i.e. g/veh-day) are based on MOVES "rate per vehicle" and "rate per profile" factors.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns or rows.
4. The width of each column can be increased or decreased by dragging the column's borders.

Run View Results

Figure 3-8. Emission Factors: On-Road tab.

calculate the emissions and the emissions values. These equations are bolded to indicate the end of the fugitive-type group.

The values for each of the variables are either constants based on literature recommendations, engineering judgment, assumptions, etc., or derived based on information provided by the user in the other tabs. The user can override any one of the default values highlighted in blue. If a variable is changed, then the calculated emissions are updated accordingly after the user presses the Apply button.

Apply (button). Pressing this button will save and implement any changes made to the default data. If any changes to the variable values have been made, emissions values will be updated after this button is pressed. After the button is pressed, a pop-up window will appear indicating the data has been saved.

3.4.10 Menus

As indicated in Figure 3-10, only two menus are available: File and Help. The File menu contains the typical Open, Save, and Exit options. The Open and Save options allow opening and

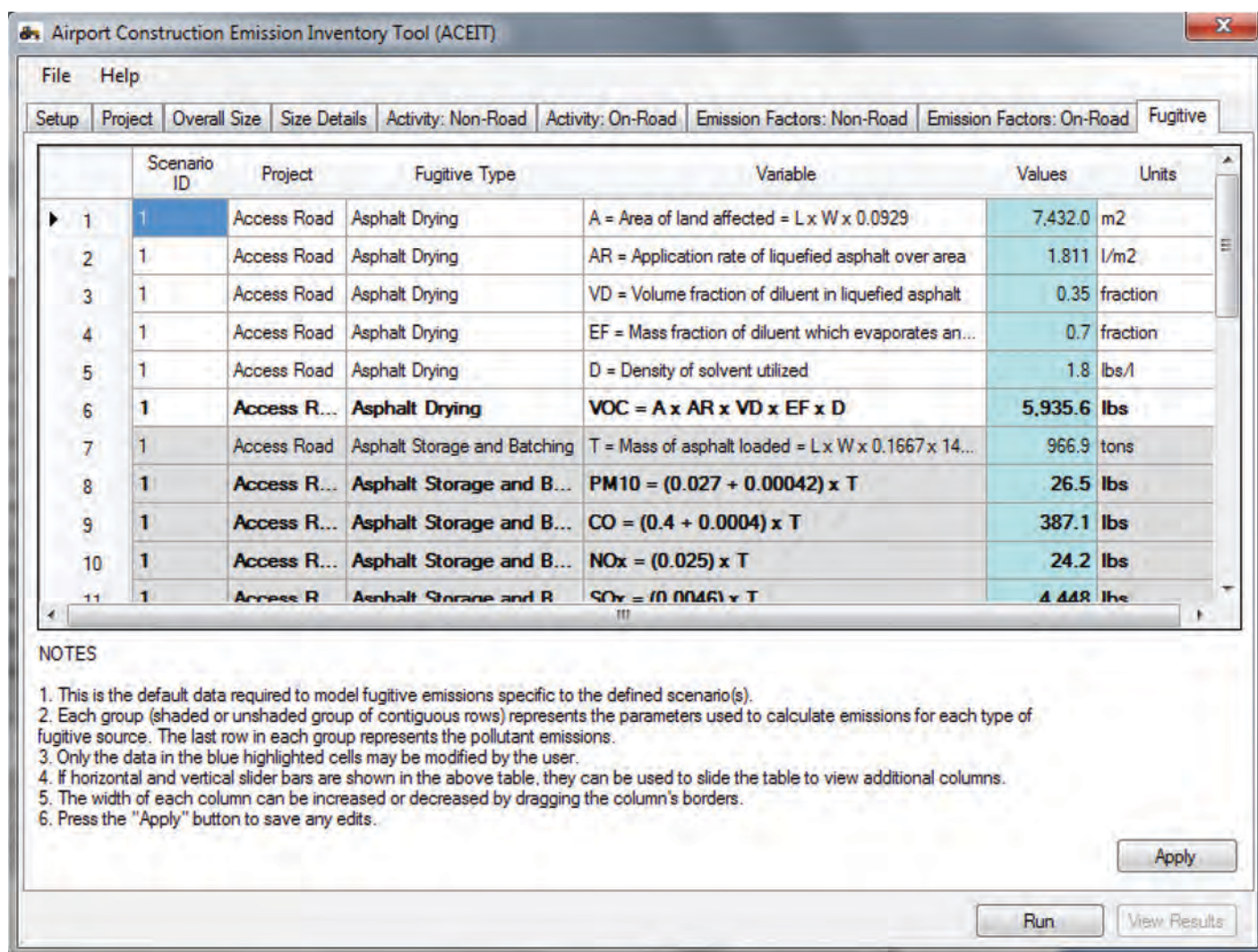


Figure 3-9. Fugitive Emissions tab.

saving an external ASCII text file that contains all of the study specifications. The Reset Application option erases all entered data and returns the program to the initial state (same as if the program had just started). The Exit option quits the program – same as clicking the “X” close control at the top right corner of the tool.

The Help Menu contains only one option: About information. This option opens a window with some project information, a disclaimer, and software version number.

3.4.11 Running the Tool and Viewing the Outputs

As illustrated in Figure 3-11, the Run and View Results buttons are located at the lower right corner of the tool. Once the scenario(s) has been specified and the minimum information supplied by the user, emissions calculations and inventories can be developed by pressing the Run button at the bottom of the tool. This button is always present irrespective of which tab is highlighted while the View Results button is initially inactive. Once the user presses the Run button and the calculations are complete, a dialogue box opens asking the user where to save the output file. The output file is formatted and saved as a comma separated values (csv) ASCII text file as

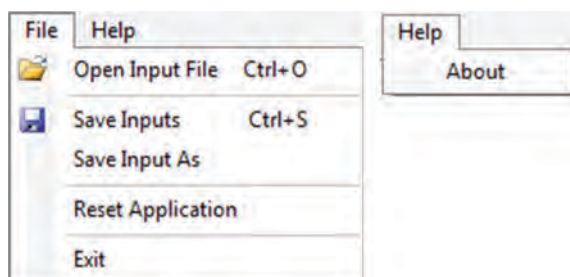


Figure 3-10. Menus.



Figure 3-11. Running emissions.

illustrated in Figure 3-12a. This file can readily be loaded in a spreadsheet such as Microsoft Excel as indicated in Figure 3-12b for easier copying and manipulation of the data. Then the View Results button becomes active and allows the user to view the output file (this button always opens the latest saved output file) by starting Excel and loading the file.

The output results begin with some overview-type information including the study name, description, and date. This is followed by summary inventories showing emissions totals by year and by equipment type. Listings of the input data are also provided, including activity information (e.g., hours of use) and emission factors for each combination of project, construction activity, and type of equipment. Finally, a list of assumptions and notes is provided at the end. A facsimile of these assumptions and notes is provided in Appendix D.

```
Airport Construction Emission Inventory Tool (ACEIT)
Version 1.0 (Prerelease)
Run Date & Time: 9/6/2013 12:01:29 PM

=====
STUDY
Study Name
Test Project

Study Description
This is a test project for demonstration purposes only.

=====
EMISSIONS INVENTORY - SUMMARY
Total Emissions by Year
Units for Non-Greenhouse Gases Emission: Short Ton
"Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton"

Year,CO,NOx,SO2,PM10,PM2.5,VOC,CO2,CH4,N2O2015,9.99159873231646,3.52454341484
Total Emissions by Source Categories
Units for Non-Greenhouse Gases Emission: Short Ton
Units for Greenhouse Gases Emission: Metric Ton

Year,Emission Source,CO,NOx,SO2,PM10,PM2.5,VOC,CO2,CH4,N2O2015,NonRoad,1.0611

=====
EMISSIONS INVENTORY - DETAILS:
Non-Road Sources
Units for Non-Greenhouse Gases Emission: Short Ton
"Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton"

Scenario ID,Year,Project,Construction Activity,Equipment,Fuel,HP Average,Load
oad,Asphalt Placement,Roller,Diesel,100,0.590,11.1,0.0019000210464156,0.00209
83417253,1.06217469689367E-05,0.00056547193178981,0.000520234177178597,0.0007
521,0.00020829107761635,0.00334915052790405,0.00308121848492251,0.00508461881
,175,0.430,64.32,0.00378470932083545,0.0151114697232833,3.80413791243722E-05,
0.000991539117979937,1.97807353488596,1,2015,Access Road,Drainage - 6 inch Pe
(Borrow),Dozer,Diesel,175,0.590,49.3333333333333,0.00493245965402213,0.012115
3513 0 00093605745452898 2 04843709669186 1 2015 Access Road Excavation (Cut
```

Figure 3-12a. Output results—comma separated values (csv) ASCII format.

Airport Construction Emissions Inventory Tool (ACEIT)										
Version 1.0										
Run Date & Time: 9/6/2013 11:46:52 AM										
STUDY										
Study Name										
Test Project										
Study Description										
This is a test project for demonstration purposes only.										
EMISSIONS INVENTORY - SUMMARY										
Total Emissions by Year										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton										
Year	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	
2015	9.991599	3.524543	0.026209	0.25749	0.169702	3.848738	1553.899	0.275863	0.012269	
Total Emissions by Source Categories										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases Emission: Metric Ton										
Year	Emission Source	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O
2015	NonRoad	1.0612	2.441304	0.008992	0.166531	0.153209	0.254018	648.3219	--	--
2015	OnRoad	8.736849	1.071139	0.014993	0.017759	0.016494	0.62092	905.5773	0.275863	0.012269
2015	Fugitive	0.19355	0.0121	0.002224	0.0732	--	2.9738	--	--	--
2015	TOTAL	9.991599	3.524543	0.026209	0.25749	0.169702	3.848738	1553.899	0.275863	0.012269

Figure 3-12b. Output results—spreadsheet format.

3.5 ACEIT Tutorials

3.5.1 Example Level 1 Assessment

A Level 1 assessment exclusively uses default data. This allows a screening-type assessment at which emissions inventories can be quickly developed at a low fidelity. Since all default data is used, the modeling work can be conducted very quickly. The following setup data represents the scenario to be modeled:

- 400 ft x 1,000 ft Terminal Apron development
- Overall estimated project cost: \$34 Million (\$10M, \$15M, and \$9M for each modeled period/scenario, respectively)
- Stonebrook International Airport (fictitious airport)
- Location: Fulton County, GA
- Timeline: August–December 2017, January–February 2018
- Daily average summer temperature: 84°F
- Daily average summer maximum and minimum temperatures: 72°F and 92°F
- Daily average winter temperature: 64°F
- Daily average winter maximum and minimum temperatures: 52°F and 70°F

Step 1

Run ACEIT and fill in the setup data as indicated in Figure 3-13. First, enter a suitable study name and description. Then select the state (Georgia) and county (Fulton) from the drop-down lists corresponding to the airport.

Because the overall timeline overlaps 2 years and different seasons, 3 scenarios were modeled as indicated below:

Scenario 1: 2017, 3 summer months (July—October)

Scenario 2: 2017, 2 winter months (November—December)

Scenario 3: 2018, 2 winter months (January—February)

For each of the seasons, select the appropriate temperature ranges to match the setup data provided. Although only one set of winter temperatures is used for both of the winter scenarios in this example, different temperatures (if available) can potentially be used to increase accuracy. Then press the Apply button to implement these scenario definitions.

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

1 2 3 <----- Please fill out the first three (3) tabs in the order shown

Minimum Data Required from User

Study Name: Stonebrook Arpt - Terminal Apr

Description: Stonebrook International Airport - Terminal Apron Development Project

State: Georgia

County: Fulton County

DISCLAIMER

While allowing users to quickly and consistently develop airport construction emissions inventories, the Airport Construction Emissions Inventory Tool (ACEIT) should only be used for planning purposes including General Conformity. It should not be used for non-airport work including transportation conformity evaluations or transportation conformity state implementation plans.

NOTES

1. The Guidebook contains a User's Guide for ACEIT.
2. At a minimum, the user needs to provide data for the first three tabs (Setup, Project, and Overall Size - in that order). The other tabs provide default data that can be modified or replaced with more accurate data supplied by the user. A checklist of minimum information requirements is provided in the appendices of the Guidebook.
3. Press the "Apply" button after entering new data or making edits.
4. Once the scenarios have been defined within the first three tabs, press the Run button to calculate emissions and develop inventories.

Scenarios:

	Scenario ID	Year	Number of Months	Season	Average Daily Temp (degF)	Max Daily Temp Change (degF)	Min Daily Temp Change (degF)
	1	2017	3	Summer	> 80	10 <= Change in T < 20	10 <= Change in T < 20
	2	2017	2	Winter	50 < T <= 80	10 <= Change in T < 20	10 <= Change in T < 20
▶	3	2018	2	Winter	50 < T <= 80	10 <= Change in T < 20	10 <= Change in T < 20
*	4						

Help: Scenario Guidance

Apply

Run View Results

Figure 3-13. Study setup data for example Terminal Apron project.

Step 2

Under the Project tab, select Scenario ID 1 (there should be three scenario choices). Then select the Terminal Apron project and press Select for all other lists, thereby accepting all the default Construction Activity Types and Fuel Types and Equipment. Leave the Fuel Type selection as diesel. Note that this results in the Asphalt Placement option being chosen rather than Concrete Placement (i.e., the Concrete Placement option is not highlighted and is not included in the Fuel Type and Equipment list).

These selections assume the user does not want to change any of the default specifications. As shown in Figure 3-14, all of the selected combinations will be listed in the Final Selections list. Repeat these steps for Scenario ID 2 and 3. Lastly, press the Apply button to apply all of these selections.

Step 3

The Overall Size tab, as shown in Figure 3-15, requires three sets of data for the Terminal Apron project—one for each scenario. This includes the overall cost and the length and width dimensions of the project (apron area). These datasets are specific to each scenario because they

Airport Construction Emission Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

1 2 3
Minimum Data Required from User

----- Please fill out the first three (3) tabs in the order shown

Scenario ID: 1

Project Type: Construction Activity Type: Fuel Type and Equipment: Final Selections:

☒ Diesel ☐ Gasoline

Project Type	Construction Activity Type	Fuel Type and Equipment	Final Selections
Fencing	Terminal Apron, Excavation (Borrow)	Terminal Apron, Sealing/Fuel Resista	Terminal Apron, Asphalt Placement, Aspha
Rehabilitate Runway	Terminal Apron, Excavation (Cut to P	Terminal Apron, Soil Erosion/Sedimer	Terminal Apron, Asphalt Placement, Dump
Detention Basin	Terminal Apron, Excavation (Topsoil)	Terminal Apron, Soil Erosion/Sedimer	Terminal Apron, Asphalt Placement, Other
Access Road	Terminal Apron, Fencing	Terminal Apron, Soil Erosion/Sedimer	Terminal Apron, Asphalt Placement, Pickup
Terminal Apron	Terminal Apron, Grading	Terminal Apron, Soil Erosion/Sedimer	Terminal Apron, Asphalt Placement, Roller
Parking Lot	Terminal Apron, Hydroseeding	Terminal Apron, Subbase Placement,	Terminal Apron, Asphalt Placement, Skid S
Helipad	Terminal Apron, Lighting	Terminal Apron, Subbase Placement,	Terminal Apron, Asphalt Placement, Surfac
Fuel Tanks	Terminal Apron, Markings	Terminal Apron, Subbase Placement,	Terminal Apron, Clearing and Grubbing, Ch
Cargo Apron	Terminal Apron, Sealing/Fuel Resist	Terminal Apron, Subbase Placement,	Terminal Apron, Clearing and Grubbing, Ch
Apron (GA)	Terminal Apron, Soil Erosion/Sedime	Terminal Apron, Topsoil Placement, D	Terminal Apron, Clearing and Grubbing, Pic
Tiedowns	Terminal Apron, Subbase Placement	Terminal Apron, Topsoil Placement, D	Terminal Apron, Drainage - 24 inch SICPP
Landscaping	Terminal Apron, Topsoil Placement	Terminal Apron, Topsoil Placement, P	Terminal Apron, Drainage - 24 inch SICPP

Select Select Delete Select Delete Delete

NOTES

1. At least one project from the Project Type list must be selected (highlighted) to define a scenario.
2. To select multiple items, click an item and while keeping the left mouse button down, drag to the desired item. To highlight non-contiguous groups, press the Ctrl key while selecting a new set of items.
3. The items in each succeeding list (left to right) show the combinations of categories from the previous lists.
4. The horizontal and vertical slider bars in the above lists can be used to view any hidden parts of the listed items.
5. Under the Construction Activity Type list, when a choice between asphalt and concrete materials occurs, asphalt is always selected as default. To choose concrete, de-select the asphalt item and select the corresponding concrete item.
6. Press the "Apply" button to save the data or any edits.

Clear All

Apply

Run View Results

Figure 3-14. Terminal Apron example with default construction activities and equipment.

File Help

Setup Project **Overall Size** Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

① ② ③ <----- Please fill out the first three (3) tabs in the order shown

Minimum Data Required from User

	Scenario ID	Project	Project Size Question	User Input	Unit
1	1	Terminal Apron	What is the estimated cost of the project?	10	\$ Million(s)
2	1	Terminal Apron	What is the maximum length of the terminal apron (L) in feet?	1000	Feet
3	1	Terminal Apron	What is the maximum width of the terminal apron (W) in feet?	400	Feet
4	2	Terminal Apron	What is the estimated cost of the project?	15	\$ Million(s)
5	2	Terminal Apron	What is the maximum length of the terminal apron (L) in feet?	1000	Feet
6	2	Terminal Apron	What is the maximum width of the terminal apron (W) in feet?	400	Feet
7	3	Terminal Apron	What is the estimated cost of the project?	9	\$ Million(s)
8	3	Terminal Apron	What is the maximum length of the terminal apron (L) in feet?	1000	Feet
9	3	Terminal Apron	What is the maximum width of the terminal apron (W) in feet?	400	Feet

NOTES

1. This is the minimal set of overall project size and characteristics data necessary to model each scenario.
2. Only the data in the blue highlighted cells may be modified by the user.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns and rows.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. The overall cost of the project is necessary to estimate the number of workers to calculate total travel from home to work and vice versa.
6. The overall size data should be specific to each scenario (e.g., the cost value is specific to each scenario).
7. Press the "Apply" button to save the data or any edits.
8. Once the scenarios have been defined within the first three tabs, press the Run button to calculate emissions and develop inventories.

Apply

Run View Results

Figure 3-15. Overall Size data for a Terminal Apron development project.

each define the overall size of each scenario. Press the Apply button to implement the overall size information.

Step 4

Since all other sheets present default data (Level 1) to be used in calculating emissions, no further inputs would be available. The user can then choose to press the Run button to begin the emissions calculations and save the csv file. The resulting emissions inventory in the output file as shown in Figure 3-16 reflects the use of minimal data and full default settings.

The aggregated emissions presented under the Summary section represents the project-related construction emissions on a yearly basis. These can be summed with any other non-construction project emissions to represent the overall, net project emissions impacts. The criteria pollutant emissions can be used to compare against the General Conformity *de minimis* thresholds while the greenhouse gas emissions can be used for various purposes, including disclosure within NEPA documents.

Airport Construction Emissions Inventory Tool (ACEIT)										
Version 1.0										
Run Date & Time: 9/6/2013 12:23:20 PM										
STUDY										
Study Name										
Stonebrook Arpt - Terminal Apr										
Study Description										
Stonebrook International Airport - Terminal Apron Development Project										
EMISSIONS INVENTORY - SUMMARY										
Total Emissions by Year										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton										
Year	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	
2017	7.897195	8.125229	0.051293	1.579698	0.437077	30.85931	3298.657	0.138464	0.022905	
2018	3.180764	3.084326	0.021614	0.881357	0.146809	15.4062	1689.245	0.019497	0.01166	
Total Emissions by Source Categories										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases Emission: Metric Ton										
Year	Emission !	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O
2017	NonRoad	3.139164	6.879689	0.022785	0.422971	0.389134	0.989896	2698.721	--	--
2017	OnRoad	2.822331	1.12464	0.006308	0.049676	0.047943	0.131609	599.9359	0.138464	0.022905
2017	Fugitive	1.9357	0.1209	0.0222	1.10705	--	29.7378	--	--	--
2017	TOTAL	7.897195	8.125229	0.051293	1.579698	0.437077	30.85931	3298.657	0.138464	0.022905

Figure 3-16. Resulting emissions inventory file for Level 1 assessment example.

3.5.2 Example Level 2 Assessment

For this example, the same study data from the Level 1 assessment is used (Section 3.5.1) as a starting basis. The main difference is that in this Level 2 example, the user has access to more accurate activity data. Based on experiences gained from prior projects, the following refinements to the activity data are made:

- Asphalt Placement
 - Asphalt Paver 52 hours
 - Dump Truck No data
 - Other General Equipment No data
 - Pickup Truck No data
 - Roller 52 hours

- Skid Steer Loader 40 hours
- Surfacing Equipment 44 hours
- Clearing and Grubbing
 - Chain Saw 80 hours
 - Chipper/Stump Grinder 90 hours
 - Pickup Truck No data
- Drainage – 24 inch SICPP
 - Dozer 52 hours
- etc.

Although refinements are made to only a few activity data, they will still provide more accurate modeling. For those cases where “no data” is indicated, default values within ACEIT are used. The data for Scenarios 2 and 3 are also similarly refined. The new data is implemented as shown in Figure 3-17 (the highlighted yellow cells). The user needs to make sure to press the Apply button whenever new data is implemented. For this example, only the above data for Scenario ID 1 are implemented.

	Scenario ID	Project	Construction Activity	Equipment	Fuel Type	Activity Size	Activity Rate	Activity Data	Activity Unit
1	1	Terminal Ap...	Asphalt Pla...	Asphalt Paver	Diesel	44,400.00 SY	8 Hours per 6,400 SY	52	hours
2	1	Terminal Ap...	Asphalt Pla...	Dump Truck	Diesel	44,400.00 SY	8 Hours per 1,777 SY	199.9	hours
3	1	Terminal Ap...	Asphalt Pla...	Other Gener...	Diesel	44,400.00 SY	16 Hours per 6,400 SY	111.0	hours
4	1	Terminal Ap...	Asphalt Pla...	Pickup Truck	Diesel	44,400.00 SY	8 Hours per 6,400 SY	55.5	hours
5	1	Terminal Ap...	Asphalt Pla...	Roller	Diesel	44,400.00 SY	8 Hours per 6,400 SY	52	hours
6	1	Terminal Ap...	Asphalt Pla...	Skid Steer L...	Diesel	44,400.00 SY	8 Hours per 6,400 SY	40	hours
7	1	Terminal Ap...	Asphalt Pla...	Surfacing E...	Diesel	44,400.00 SY	8 Hours per 5,000 SY	44	hours
8	1	Terminal Ap...	Clearing an...	Chain Saw	Diesel	9.50 Acre	12 Hours per 1 Acre	80	hours
9	1	Terminal Ap...	Clearing an...	Chipper/Stu...	Diesel	9.50 Acre	12 Hours per 1 Acre	90	hours
10	1	Terminal Ap...	Clearing an...	Pickup Truck	Diesel	9.50 Acre	16 Hours per 1 Acre	152.0	hours
11	1	Terminal Ap...	Drainage - 2...	Dozer	Diesel	1,010.00 LF	8 Hours per 250 LF	52	hours

NOTES

1. This is the non-road equipment default activity data of the defined scenario(s).
2. Only the data in the blue highlighted cells may be modified by the user.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns or rows.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. Press the "Apply" button to save any edits.

Create Non-Road Activity Data List Apply Run View Results

Figure 3-17. Updated activity data for non-road equipment for Level 2 assessment example.

52 Guidance for Estimating Airport Construction Emissions

Similarly, the user makes refinements to the on-road vehicle activities. Rather than using the default VMTs for employee travel (which uses a nominal 40 mile round-trip estimate for each person per work day), more accurate estimates are made based on worker home address and/or zip code listings:

- Scenario 1: estimated summer 2017 total VMT 150,000
- Scenario 2: estimated winter 2017 total VMT 180,000
- Scenario 3: estimated winter 2018 total VMT 110,000

No further information is available to develop more accurate VMT data for material deliveries. The data are implemented as shown by the highlighted yellow cells in Figure 3-18.

All other datasets are unchanged from the default settings. The user then presses the Run button to calculate emissions and generate the csv output file. Pressing the View button opens the file in Microsoft Excel as seen in Figure 3-19, which reflects the use of user-defined activity data for a Level 2 assessment.

The differences in the emissions results from those generated under the Level 1 example are due to the more accurate activity data (non-road equipment hours of usage and on-road vehicle

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Equipment	On-road Activity	Fuel	Roadway	VMT
1	1	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	5,804
2	1	Terminal Apr...	Cement Mixer	Material Delivery	Diesel	Urban Unrestricted Access	92,500
3	1	Terminal Apr...	Dump Truck - Asphalt	Material Delivery	Diesel	Urban Unrestricted Access	8,222
4	1	Terminal Apr...	Dump Truck Subbas...	Material Delivery	Diesel	Urban Unrestricted Access	49,333
5	1	Terminal Apr...	Passenger Car	Employee Com...	Gasoline	Urban Unrestricted Access	150,000
6	2	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	5,804
7	2	Terminal Apr...	Cement Mixer	Material Delivery	Diesel	Urban Unrestricted Access	92,500
8	2	Terminal Apr...	Dump Truck - Asphalt	Material Delivery	Diesel	Urban Unrestricted Access	8,222
9	2	Terminal Apr...	Dump Truck Subbas...	Material Delivery	Diesel	Urban Unrestricted Access	49,333
10	2	Terminal Apr...	Passenger Car	Employee Com...	Gasoline	Urban Unrestricted Access	180,000
11	3	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	5,804

NOTES

1. This is the on-road equipment default activity data of the defined scenario(s).
2. Only the data in the blue highlighted cells may be modified by the user, but the other fields allow modifications to redefine equipment types, fuel types, etc.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. Press the "Apply" button to save any edits.
6. Each row can be deleted by clicking the row in the left-most column of the table, and then pressing the delete button.
7. If an existing Scenario ID is changed, the user must also select the appropriate corresponding Project type when there is more than one Project type modeled for a scenario.

Create On-Road Activity Data List Apply

Run View Results

Figure 3-18. Updated activity data for on-road vehicles for Level 2 assessment example.

Airport Construction Emission Inventory Tool (ACEIT)										
Version 1.0 (Prerelease)										
Run Date & Time: 9/6/2013 12:46:06 PM										
=====										
STUDY										
Study Name										
Stonebrook Arpt - Terminal Apr										
Study Description										
Stonebrook International Airport - Terminal Apron Development Project										
=====										
EMISSIONS INVENTORY - SUMMARY										
Total Emissions by Year										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton										
Year	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	
2017	7.448344	8.091024	0.05057	1.571992	0.430221	30.82184	3259.74	0.129548	0.022477	
2018	3.043689	3.076919	0.021529	0.877757	0.143558	15.38761	1683.25	0.018502	0.011518	
Total Emissions by Source Categories										
Units for Non-Greenhouse Gases Emission: Short Ton										
Units for Greenhouse Gases Emission: Metric Ton										
Year	Emission Source	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O
2017	NonRoad	2.961547	6.868625	0.0227	0.416203	0.382907	0.95282	2698.045	--	--
2017	OnRoad	2.551097	1.101499	0.00567	0.048739	0.047314	0.131216	561.6949	0.129548	0.022477
2017	Fugitive	1.9357	0.1209	0.0222	1.10705	--	29.7378	--	--	--
2017	TOTAL	7.448344	8.091024	0.05057	1.571992	0.430221	30.82184	3259.74	0.129548	0.022477

Figure 3-19. Resulting emissions inventory file for Level 2 assessment example.

VMT). In this case, the more accurate data resulted in reduced emissions (lower emissions than the Level 1 example using default data). Although it is possible that more accurate user inputs can result in either a decrease or increase in emissions, it is expected that under most cases, the default data under Level 1 assessments will tend to produce more conservative results (higher emissions).

3.5.3 Example Level 3 Assessment

Similar to the previous example, the starting point is Level 1 assessment (Section 3.5.1). Therefore, the same data supplied by the user in the Setup, Project, and Overall Size tabs are used for this example as well. However, instead of just some of the activity data being supplied by the user, most of the data is user supplied. The user presses the Create Non-Road Activity Data List

button on the Activity: Non-Road tab (see Figure 3-5) to create a facsimile of the activity data list to use to inquire with airport planners, project managers, and engineers to obtain a more comprehensive and more accurate set of activity data as illustrated below:

- Asphalt Placement
 - Asphalt Paver 52 hours
 - Dump Truck 175 hours
 - Other General Equipment 100 hours
 - Pickup Truck 38 hours
 - Roller 45 hours
 - Skid Steer Loader 40 hours
 - Surfacing Equipment 38 hours
- Clearing and Grubbing
 - Chain Saw 76 hours
 - Chipper/Stump Grinder 80 hours
 - Pickup Truck 120 hours
- Drainage – 24 inch SICPP
 - Dozer 40 hours
- etc.

For those types of equipment where more than one activity value is available (i.e., from different sources), the user processes the data such that in some cases, the data provided by the more confident source is used while in other cases, where two or more values appear to be equally valid, averages are used. The burden is on the user to determine the appropriate sources and the usability of the collected data. Figure 3-20 shows the implemented data (highlighted yellow cells). The user needs to make sure to press the Apply button whenever new data is implemented. For this example, only the above data for Scenario ID 1 are implemented.

For the on-road data, the user again presses the Create On-Road Activity Data List button on the Activity: On-Road tab (see Figure 3-6) to create a facsimile of the activity data list. Similar to equipment hours-of-usage activity data, more accurate and comprehensive VMT estimates are also obtained as shown below and implemented in Figure 3-21 (highlighted yellow cells):

- Scenario 1 (summer 2017)
 - Material transport
 - Asphalt 18 Wheeler total VMT 4,500
 - Cement Mixer total VMT 80,000
 - Dump Truck – Asphalt total VMT 2,000
 - Dump Truck – Subbase total VMT 40,000
 - Employee travel
 - Passenger car total VMT 150,000
- Scenario 2 (winter 2017)
 - Material transport
 - Asphalt 18 Wheeler total VMT 2,100
 - Cement Mixer total VMT 36,000
 - Dump Truck – Asphalt total VMT 2,000
 - Dump Truck – Subbase total VMT 34,000
 - Employee travel
 - Passenger car total VMT 180,000
- Scenario 3 (winter 2018)
 - Material transport
 - Asphalt 18 Wheeler total VMT 2,600

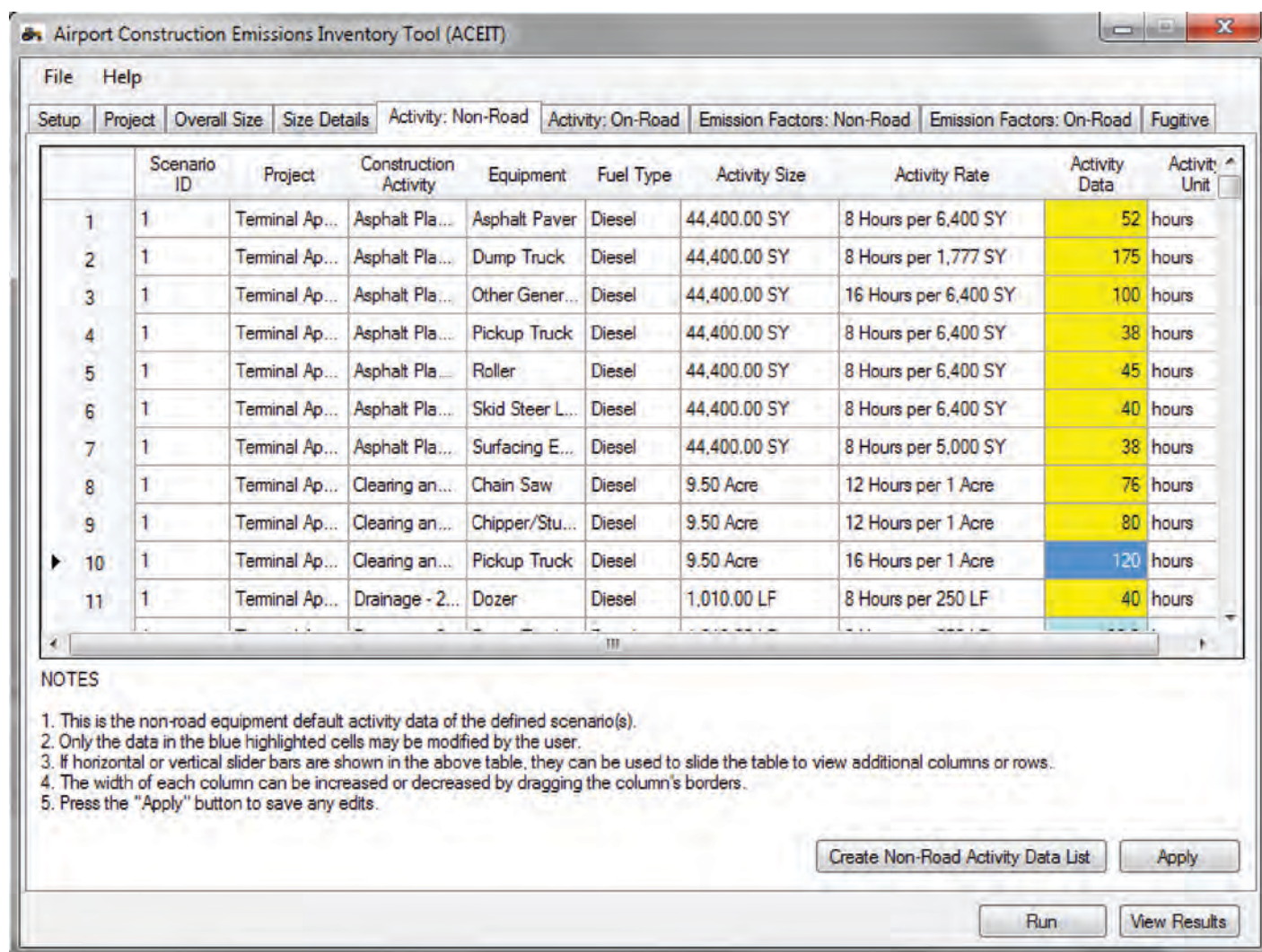


Figure 3-20. Updated activity data for non-road equipment for Level 3 example.

- Cement Mixer total VMT 47,000
- Dump Truck – Asphalt total VMT 2,000
- Dump Truck – Subbase total VMT 42,000
- Employee travel
- Passenger car total VMT 110,000

Lastly, the user also has more accurate data to improve some of the fugitive emissions estimations. The user-supplied data are summarized below and the implementation is shown in Figure 3-22 (highlighted yellow cells).

- Material movement (paved roads) mean vehicle weight 25 tons
- Material movement (unpaved roads) mean vehicle weight 30 tons

For this example, the data are only applied to Scenario ID 1 and asphalt placement activities.

Once all of the user-supplied data have been implemented in ACEIT, making sure to press the Apply button whenever new data have been entered on each tab, the user can press the Run button

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Equipment	On-road Activity	Fuel	Roadway	VMT
1	1	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	4,500
2	1	Terminal Apr...	Cement Mixer	Material Delivery	Diesel	Urban Unrestricted Access	80,000
3	1	Terminal Apr...	Dump Truck - Asphalt	Material Delivery	Diesel	Urban Unrestricted Access	2,000
4	1	Terminal Apr...	Dump Truck Subbas...	Material Delivery	Diesel	Urban Unrestricted Access	40,000
5	1	Terminal Apr...	Passenger Car	Employee Com...	Gasoline	Urban Unrestricted Access	150,000
6	2	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	2,100
7	2	Terminal Apr...	Cement Mixer	Material Delivery	Diesel	Urban Unrestricted Access	36,000
8	2	Terminal Apr...	Dump Truck - Asphalt	Material Delivery	Diesel	Urban Unrestricted Access	2,000
9	2	Terminal Apr...	Dump Truck Subbas...	Material Delivery	Diesel	Urban Unrestricted Access	34,000
10	2	Terminal Apr...	Passenger Car	Employee Com...	Gasoline	Urban Unrestricted Access	180,000
11	3	Terminal Apr...	Asphalt 18 Wheeler	Material Delivery	Diesel	Urban Unrestricted Access	2,600

NOTES

1. This is the on-road equipment default activity data of the defined scenario(s).
2. Only the data in the blue highlighted cells may be modified by the user, but the other fields allow modifications to redefine equipment types, fuel types, etc.
3. If horizontal or vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns.
4. The width of each column can be increased or decreased by dragging the column's borders.
5. Press the "Apply" button to save any edits.
6. Each row can be deleted by clicking the row in the left-most column of the table, and then pressing the delete button.
7. If an existing Scenario ID is changed, the user must also select the appropriate corresponding Project type when there is more than one Project type modeled for a scenario.

Create On-Road Activity Data List Apply

Run View Results

Figure 3-21. Updated activity data for on-road vehicles for Level 3 example.

Airport Construction Emissions Inventory Tool (ACEIT)

File Help

Setup Project Overall Size Size Details Activity: Non-Road Activity: On-Road Emission Factors: Non-Road Emission Factors: On-Road Fugitive

	Scenario ID	Project	Fugitive Type	Variable	Values	Units
72	3	Terminal ...	Asphalt Storage and B...	$VOC = (0.0082 + 0.0042) \times T$	59.9	lbs
73	3	Terminal Ap...	Material Movement (Unpav...	$s = \text{Surface material silt content}$	0.043	fraction
74	3	Terminal Ap...	Material Movement (Unpav...	$Wt. = \text{Mean vehicle weight}$	30	tons
75	3	Terminal Ap...	Material Movement (Unpav...	$VMT = \text{Vehicle miles traveled}$	11,193.8	miles
76	3	Terminal ...	Material Movement (U...	$PM_{10} = 1.5 \times [(s/12)^{0.9}] \times [(Wt./3)^{0.4}] \times V$	297.8	lbs
77	3	Terminal Ap...	Material Movement (Paved ...	$sL = \text{Road surface silt loading}$	0.1	g/m3
78	3	Terminal Ap...	Material Movement (Paved ...	$Wt. = \text{Mean vehicle weight}$	25	tons
79	3	Terminal Ap...	Material Movement (Paved ...	$VMT = \text{Vehicle miles traveled}$	10,105.0	miles
80	3	Terminal ...	Material Movement (Pa...	$PM_{10} = 0.0022 \times (sL^{0.91}) \times (Wt^{1.02}) \times V$	93.8	lbs
81	3	Terminal Ap...	Concrete Mixing/Batching	$V = \text{Volume of asphalt} = 0.111 \times L \times W \times 1.25 / 3$	18,500.0	yd3
82	3	Terminal ...	Concrete Mixing/Batch...	$PM_{10} = 0.037 \times V$	684.5	lbs

NOTES

1. This is the default data required to model fugitive emissions specific to the defined scenario(s).
2. Each group (shaded or unshaded group of contiguous rows) represents the parameters used to calculate emissions for each type of fugitive source. The last row in each group represents the pollutant emissions.
3. Only the data in the blue highlighted cells may be modified by the user.
4. If horizontal and vertical slider bars are shown in the above table, they can be used to slide the table to view additional columns.
5. The width of each column can be increased or decreased by dragging the column's borders.
6. Press the "Apply" button to save any edits.

Apply

Run View Results

Figure 3-22. Updated Fugitive emissions data for Level 3 example.

Airport Construction Emissions Inventory Tool (ACEIT)									
Version 1.0									
Run Date & Time: 9/6/2013 12:57:35 PM									
STUDY									
Study Name									
Stonebrook Arpt - Terminal Apr									
Study Description									
Stonebrook International Airport - Terminal Apron Development Project									
EMISSIONS INVENTORY - SUMMARY									
Total Emissions by Year									
Units for Non-Greenhouse Gases Emission: Short Ton									
Units for Greenhouse Gases (CO ₂ , CH ₄ , and N ₂ O) Emission: Metric Ton									
Year	CO	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	CO ₂	CH ₄	N ₂ O
2017	7.246933	7.679966	0.04925	1.553176	0.412027	30.80952	3094.482	0.094161	0.015057
2018	2.994632	2.992616	0.020884	0.872116	0.142325	15.38519	1601.708	0.013446	0.007091
Total Emissions by Source Categories									
Units for Non-Greenhouse Gases Emission: Short Ton									
Units for Greenhouse Gases Emission: Metric Ton									
Year	Emission : CO	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	CO ₂	CH ₄	N ₂ O
2017 NonRoad	2.936426	6.828736	0.022563	0.413514	0.380433	0.945647	2682.244	--	--
2017 OnRoad	2.374807	0.73033	0.004487	0.032612	0.031594	0.126075	412.238	0.094161	0.015057
2017 Fugitive	1.9357	0.1209	0.0222	1.10705	--	29.7378	--	--	--
2017 TOTAL	7.246933	7.679966	0.04925	1.553176	0.412027	30.80952	3094.482	0.094161	0.015057

Figure 3-23. Resulting emissions inventory file for Level 3 assessment example.

to calculate the emissions inventory. Then pressing the View Results button will start Microsoft Excel and load the results as indicated in Figure 3-23.

The user-supplied data under this Level 3 example resulted in emissions lower than those of the Level 1 and 2 examples. As such, it again illustrates the expectation that in many cases, the user-supplied data may result in lower emissions since the default data in ACEIT will tend to represent conservative scenarios.



References

- Environmental Protection Agency (EPA) (1995). *Emission Factors & AP 42, Compilation of Air Pollutant Emission Factors*. Fifth Edition. January.
- Environmental Protection Agency (EPA) (2009). *EPA NONROAD Model Updates of 2008, NONROAD2008*. EPA Office of Transportation and Air Quality. International Emission Inventory Conference. EPA-420-F-09-020. April.
- Environmental Protection Agency (EPA) (2012). *Motor Vehicle Emission Simulator (MOVES), User Guide for MOVES2010b*. Assessment and Standards Division, Office of Transportation and Air Quality. EPA-420-B-12-001b. June.
- Environmental Protection Agency (EPA) and Federal Aviation Administration (FAA) (2002). *General Conformity Guidance for Airports: Questions and Answers*, September 25, 2002. http://www.epa.gov/ttn/oarpg/conform/airport_qa.pdf
- Federal Aviation Administration (FAA) (2006). *Environmental Impacts: Policies and Procedures*. Order 1050.1E (CHG 1). http://www.faa.gov/documentLibrary/media/order/energy_orders/1050-1E.pdf. March 20.
- Federal Aviation Administration (FAA) (2010). *Emissions and Dispersion Modeling System (EDMS) User's Manual, EDMS 5.1.3*. FAA-AEE-07-01. Revision 8.
- Kim, Brian, Ian A. Waitz, Mary Vigilante, and Royce Bassarab (2009). *ACRP Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. Transportation Research Board of the National Academies, Washington, D.C.
- KB Environmental Sciences, Inc., Environmental Science Associates, Inc., Synergy Consultants, Inc., and Stonefield Environmental Consulting (2012). *ACRP Report 84: Guidebook for Preparing Airport Emissions Inventories for State Implementation Plans*. Transportation Research Board of the National Academies, Washington, D.C. <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2792>.



Acronyms

ACEIT	Airport Construction Emissions Inventory Tool
AEDT	Aviation Environmental Design Tool
AIP	Airport Improvement Program
ALP	Airport Layout Plan
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH ₄	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO _{2e}	Carbon Dioxide Equivalent
csv	Comma Separated Values
E	Emissions
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System
EF	Emission Factor
EIS	Environmental Impact Statement
EPDM	Ethylene Propylene Diene Monomer
ft	Foot
ft ²	Square Foot
g	Gram
GHG	Greenhouse Gas
GUI	Graphical User Interface
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
HMA	Hot Mix Asphalt
hr	Hour
ID	Identification
ILS	Instrument Landing System
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
lb	Pound
l	Liter
LNG	Liquefied Natural Gas
LPG	Liquid Petroleum Gas
m ²	Square Meter
MOVES	Motor Vehicle Emissions Simulator
MTBE	Methyl Tertiary-Butyl Ether

N ₂ O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAVAID	Navigational Aid
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NH ₃	Ammonia
NMHC	Non-Methane Hydrocarbon
NMOG	Non-Methane Organic Gas
NO	Nitrogen Oxide
NONROAD	Non-Road Equipment Emission Model
NO _x	Nitrogen Oxides (or Oxides of Nitrogen)
O ₃	Ozone
PAPI	Precision Approach Path Indicator
P	Power
Pb	Lead
PFC	Perfluorocarbon
PFC	Passenger Facility Charge
PM	Particulate Matter
PM ₁₀	Particulate Matter with Aerodynamic Diameter Less Than 10 Micrometers
PM _{2.5}	Particulate Matter with Aerodynamic Diameter Less Than 2.5 Micrometers
RAM	Random Access Memory
RB	Rotating Beacon
RP	Rate per Profile
RV	Rate per Vehicle
SICPP	Smooth Interior Corrugated Polyethylene Pipe
SF ₆	Sulfur Hexafluoride
SIP	State Implementation Plan
SO ₂	Sulfur Dioxide
THC	Total Hydrocarbons
TOG	Total Organic Gases
VTM	Vehicle Miles Traveled
VOC	Volatile Organic Compound
W	Mean Vehicle Weight
yd ²	Square Yard
yd ³	Cubic Yard
μm	Micrometers

APPENDIX A

Selected Construction Equipment Pictures

Table A-1. Selected construction equipment pictures.

Equipment Name	Picture	Reference
Aerial Lifts		Photo provided by Terex Aerial Work Platforms http://www.genielift.com/en/products/new-equipment/boom-lifts/articulating-booms-engine/index.htm
Auger Drills		Credit: Ildar Sagdejev / File:2009-02-23 Skid steer with extreme duty auger.jpg / http://en.wikipedia.org/wiki/File:2009-02-23_Skid_steer_with_extreme_duty_auger.jpg
Bore/Drill Rigs		Provided by Kris Russell of Dallas/Fort Worth International Airport

(continued on next page)

Table A-1. (Continued).

Bulldozers		Credit: MathKnight / "Caterpillar D10N bulldozer" / http://commons.wikimedia.org/wiki/File:CAT-D10N-pic001.jpg
Cement & Mortar Mixers		Credit: David Benbennick / File:Cement mixer.jpg / http://en.wikipedia.org/wiki/File:Cement_mixer.jpg
Chain Saws		Photo provided by Black and Decker http://www.blackanddecker.com/outdoor/CCS818B.aspx
Chippers/Stump Grinders (Lawn and Garden Equipment)	 © VERMEER CORPORATION. All Rights Reserved	Photo provided by Vermeer Corporation http://www2.vermeer.com/vermeer/NA/en/N/equipment/stump_cutters/sc372 "VERMEER SHALL HAVE NO LIABILITY WITH RESPECT TO ITS OBLIGATIONS UNDER THIS LICENSE OR OTHERWISE FOR DIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES, EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL VERMEER'S LIABILITY, FOR ANY REASON WHATSOEVER, EXCEED ONE HUNDRED DOLLARS (\$100.00)."

Table A-1. (Continued).

Compactors		Provided by Kris Russell of Dallas/Fort Worth International Airport
Concrete / Industrial Saws		Photo provided by Wacker Neuson http://products.wackerneuson.com/webapp/ecommerce/itemDisplay?page=1&partNbr=0620086
Cranes		Provided by Kris Russell of Dallas/Fort Worth International Airport
Crushing/Proc. Equipment		Provided by Kris Russell of Dallas/Fort Worth International Airport
Dump Trucks		Provided by Kris Russell of Dallas/Fort Worth International Airport

(continued on next page)

Table A-1. (Continued).

Excavators		Provided by Kris Russell of Dallas/Fort Worth International Airport
Forklifts		Provided by Kris Russell of Dallas/Fort Worth International Airport
Generators		Provided by Kris Russell of Dallas/Fort Worth International Airport
Graders		Photo taken by MathKnight, http://en.wikipedia.org/wiki/File:Grader02.jpg
Pavers		Credit: Dw1975 / File:ABG.420.1-1387B.jpg (paver) / http://en.wikipedia.org/wiki/File:ABG.420.1-1387B.jpg

Table A-1. (Continued).

Pickup Trucks		Credit: Aavindraa / 1997 Ford F-150 XLT / http://en.wikipedia.org/wiki/File:1997_Ford_F-150_XLT.jpg
Pressure Washers		Photo provided by Karcher Commercial and Industrial http://www.karchercommercial.com/viewCategories.aspx?Pid=424
Rollers		Provided by Kris Russell of Dallas/Fort Worth International Airport
Rough Terrain Forklifts		Photo taken by Calibas, 14 November 2007, http://en.wikipedia.org/wiki/File:Telescopic_handler2.jpg
Rubber Tired Loader		Photo taken by Wyle

(continued on next page)

Table A-1. (Continued).

Scrapers		Photo taken by Bill Jacobus, 18 March 2006, http://en.wikipedia.org/wiki/File:Scraper.jpg
Signal Boards/Light Plants		Photo provided by Wacker Neuson http://products.wackerneuson.com/webapp/ecommerce/itemDisplay?page=1&partNbr=0620893
Skid Steer Loaders		Provided by Kris Russell of Dallas/Fort Worth International Airport
Sweepers/Scrubbers	 	Provided by Kris Russell of Dallas/Fort Worth International Airport Provided by Kris Russell of Dallas/Fort Worth International Airport

Table A-1. (Continued).

		Provided by Kris Russell of Dallas/Fort Worth International Airport
Tractors/Loaders/Backhoes		Provided by Kris Russell of Dallas/Fort Worth International Airport
Trenchers		Provided by Kris Russell of Dallas/Fort Worth International Airport
Water Trucks		Provided by Kris Russell of Dallas/Fort Worth International Airport
Welders		Photo provided by Miller Electric Mfg. Co. http://www.millerwelds.com/products/mig/product.php?model=M00151



APPENDIX B

Project, Activity, and Equipment

Table B-1. Airport construction projects.

Project Category	Project
Site/Civil	New Runway
Site/Civil	Runway Extension
Site/Civil	Runway Safety Area
Site/Civil	Runway Markings
Site/Civil	Airfield Lighting
Site/Civil	Runway Drains
Site/Civil	Service Road
Site/Civil	Taxiway Exit
Site/Civil	Taxiways
Site/Civil	NAVAIDS
Site/Civil	Fencing
Site/Civil	Rehabilitate Runway
Site/Civil	Detention Basin
Site/Civil	Access Road
Site/Civil	Terminal Apron
Site/Civil	Parking Lot
Site/Civil	Helipad
Site/Civil	Fuel Tanks
Site/Civil	Cargo Apron
Site/Civil	Apron (GA)
Site/Civil	Tiedowns
Site/Civil	Landscaping
Site/Civil	Drainage System
Site/Civil	Noise Barrier
Vertical	Building - 10000 sqft- 1 story
Vertical	Building - 100000 sqft- 10 stories
Vertical	Building - 30000 sqft- 3 stories
Vertical	Building - 500000 sqft- 20 stories
Vertical	Carwash - 1600 sqft- 1 story
Vertical	Convenience Store - 1200 sqft- 1 story
Vertical	Fire Station - 20000 sqft- 1 story
Vertical	Gas Station - 1400 sqft- 1 story
Vertical	Hangar Building - 10000 sqft- 1 story
Vertical	Open Parking Lot @Grade - 10000 sqft
Vertical	Parking Structure - 160000 sqft- G+1 story
Vertical	Parking Structure - 240000 sqft- G+2 stories
Vertical	Site Work - 10000 sqft
Vertical	Demolition - Asphalt
Vertical	Demolition - Concrete
Vertical	Demolition - Building

Table B-2. Construction activities.

Construction Activities
16 Ga. Heavy Metal Framing
17 Ga. Heavy Metal Framing
18 Ga. Heavy Metal Framing
19 Ga. Heavy Metal Framing
Approach Lighting
Asphalt Demolition
Asphalt Pavement/ Curbs
Asphalt Pavement-Ground Floor
Asphalt Placement
Binder Coat of Pavement
Building Demolition
Clearing and Grubbing
Clearing and Grubbing with approach lighting
Cold Milling
Concrete Demolition
Concrete Foundation Footings
Concrete Foundations
Concrete Placement
Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile
Concrete Post-Tensioned Frame
Construction Mob & Layout
Construction/Erect Tanks
Curbing
Drainage
Drainage - 24 inch Reinforced Concrete Pipe
Drainage - 24 inch SICPP
Drainage - 6 inch Perforated Underdrain
Drainage Structures
Dust Control
Erection of Pre-Engineered Metal Building
Excavation (Borrow)
Excavation (Cut to Fill)
Excavation (Cut to Fill) (Assume 20% reconstruction)
Excavation (Topsoil Stripping)
Exterior Wall Framing
Exterior Wall Framing-Panel & Store-Front
Fencing
Grading
Grub the site down 2 ft
Horizontal Deck Pours
Hydroseeding
Install EPDM Roofing System
Install Equipment & Start-up
Instrument Landing System (ILS) Glide Slope
ILS Localizer
Interior Build-Out/ Finishes
Interior Build-Out/ Finishes/Doors & Windows
Lighting
Lighting Precast Concrete Piers (10)
Lights and Power
Marking Removal
Markings
Masonry Wall 4 ft

Table B-2. (Continued).

Construction Activities
Metal joist/ Floor & roof deck
Metal joist/roof deck/ Ethylene propylene diene monomer (EPDM) Roof
Metal Panels
Mulching
Parapet Wall Construction
Pour Interior Slab on Grade
Pour Slab on Grade Floor
Pour Slab on Grade Floor & Slab on Metal Deck
Precast Concrete Exterior Panels
Precision Approach Path Indicator (PAPI)
Pre-Fab Canopies
Pre-Fab Attendant Booth
Reinforced Masonry Shell
Remove Trees and Shrubs
Roofing
Roofing-Standing Seam
Rotating Beacon
Rough Grading
Sealing Random Cracks
Sealing/Fuel Resistant
Security & Safety & Process Systems
Security & Safety Systems
Set in-place Light Poles
Sidewalks
Site Clearing- Remove Trees & Shrubs
Site Prep/Landscaping
Site Restoration- Landscaping (Curbing)
Site Restoration- Landscaping (Rough Grading)
Site Restoration- Landscaping (Top Soil Seed and Plantings)
Sodding
Soil Erosion/Control
Soil Erosion/Sediment Control
Street Lighting
Stripping
Structural Concrete Frame (20 Stories)
Structural Steel Erection
Structural Steel Erection & Decks
Structural Steel Erection & Metal Deck
Structural Steel Frame
Subbase Placement
Subgrade Materials installed
Tiedowns
Top Coat of Asphalt
Topsoil Placement
Tree Planting
Tree Pruning
U'G Services & Tanks
Under Ground Conduits
Under Ground Services to 5 ft of building
Windcone

Table B-3. Construction equipment.

Equipment
40 Ton Crane
40 Ton Crane (to unload & set tanks)
40 Ton Rough Terrain
40 Ton Rough Terrain Crane
90 Ton Crane
90 Ton Crane Supplemental Hoisting
Aerial Lift
Air Compressor
Asphalt Deliveries/Ten Wheelers
Asphalt Paver
Asphalt Paving Machine
Auger Drill
Backfill with Backhoe
Backhoe
Bob Cat
Boom Manlift
Bore/Drill Rig
Bulldozer
Caisson Drilling Rig
Chain Saw
Chipper/Stump Grinder
Cold Planer
Compacting Equipment
Concrete Boom Pump
Concrete Pump
Concrete Ready Mix Trucks
Concrete Ready Mix Trucks for Cores
Concrete Saws
Concrete Truck
Concrete Truck Pump
Concrete Vibrator
Crack Cleaner
Crack Filler (Trailer Mounted)
Crane
Crane w/ Concrete Pump
Curb/Gutter Paver
Delivery of Tanks (3)
Distributing Tanker
Dozer
Dump Truck
Dump Truck (12 cy)
Excavator
Excavator for U/G Services/Tanks
Excavator with Bucket
Excavator with Hoe Ram
Flat Bed or Dump Trucks

Table B-3. (Continued).

Equipment
Flatbed Truck
Fork Truck
Forklift
Fork Truck (Hoist)
Front Loader
Front Loader for Subgrade Materials
Front Loader/Scraper (to clear lot)
Generator
Generator Sets
Grader
Grout Mixer
Grout Mixer for Mortar
Grout Wheel Truck
Grub the site down 2 ft
High Lift
High Lift Fork Truck
Hoist Equipment with 40 Ton Rig
Hydraulic Hammer
Hydroseeder
Line Painting Truck and Sprayer
Loader
Log Chipper
Man Lift
Man Lift (Fascia Construction)
Masonry Saw
Material Delivery
Mulcher
Off-Road Truck
Other General Equipment
Paving Machine
Pickup Truck
Pile Driver
Pressure Washer
Pruning Saw/Chain Saw
Pumps
Roller
Rubber Tired Loader
Scraper
Seed Truck Spreader
Set With Fork Truck
Skid Steer Loader
Slip Form Paver
Small Dozer
Stripping Machine & Truck
Surfacing Equipment (Grooving)
Survey Crew Trucks
Sweepers
Sweepers/Scrubbers
Ten Wheelers

(continued on next page)

Table B-3. (Continued).

Equipment
Ten Wheelers- Material Delivery
Tool Truck
Tower Crane
Tractor
Tractor Trailer- Equipment Delivery
Tractor Trailer- Material Delivery
Tractor Trailer- Steel Deliveries
Tractor Trailer- Stone Delivery
Tractor Trailer- Topsoil & Seed
Tractor Trailer- Truck Delivery
Tractor Trailer with Boom Hoist- Curbs Del & Place
Tractor Trailer with Boom Hoist- Delivery
Tractor Trailers- Rebar Deliveries
Tractor Trailers Temp Fac.
Tractors/Loader/Backhoe
Trencher
Trencher for U/G Piping
Trenchers
Trowel Machine
Trowel Machines (2)
Trowel Machines (4)
Truck for Topsoil & Seed Del & Spread
Truck Tower (Manitowoc Type)
Vibratory Compactor
Water Truck

Table B-4. On-road vehicle types.

On-Road Vehicle
Asphalt 18 Wheeler
Cement Mixer
Dump Truck - Asphalt
Dump Truck - Subbase Material
Motorcycle
Passenger Car
Passenger Truck

Table B-5. Combination of airport construction projects, activities, and equipment.

Project Category	Project	Construction Activities	Equipment
Civil	Access Road	Asphalt Placement	Asphalt Paver
Civil	Access Road	Asphalt Placement	Dump Truck
Civil	Access Road	Asphalt Placement	Other General Equipment
Civil	Access Road	Asphalt Placement	Pickup Truck
Civil	Access Road	Asphalt Placement	Roller
Civil	Access Road	Asphalt Placement	Skid Steer Loader
Civil	Access Road	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Access Road	Clearing and Grubbing	Chain Saw
Civil	Access Road	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Access Road	Clearing and Grubbing	Pickup Truck
Civil	Access Road	Concrete Placement	Air Compressor
Civil	Access Road	Concrete Placement	Concrete Saws
Civil	Access Road	Concrete Placement	Concrete Truck
Civil	Access Road	Concrete Placement	Other General Equipment
Civil	Access Road	Concrete Placement	Pickup Truck
Civil	Access Road	Concrete Placement	Rubber Tired Loader
Civil	Access Road	Concrete Placement	Slip Form Paver
Civil	Access Road	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Access Road	Curbing	Concrete Truck
Civil	Access Road	Curbing	Curb/Gutter Paver
Civil	Access Road	Curbing	Other General Equipment
Civil	Access Road	Curbing	Pickup Truck
Civil	Access Road	Drainage - 24 inch SICPP	Dozer
Civil	Access Road	Drainage - 24 inch SICPP	Dump Truck
Civil	Access Road	Drainage - 24 inch SICPP	Excavator
Civil	Access Road	Drainage - 24 inch SICPP	Loader
Civil	Access Road	Drainage - 24 inch SICPP	Other General Equipment
Civil	Access Road	Drainage - 24 inch SICPP	Pickup Truck
Civil	Access Road	Drainage - 24 inch SICPP	Roller
Civil	Access Road	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Access Road	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Access Road	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Access Road	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Access Road	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Access Road	Dust Control	Water Truck
Civil	Access Road	Excavation (Borrow)	Dozer
Civil	Access Road	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Access Road	Excavation (Borrow)	Pickup Truck
Civil	Access Road	Excavation (Borrow)	Roller
Civil	Access Road	Excavation (Cut to Fill)	Dozer
Civil	Access Road	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Access Road	Excavation (Cut to Fill)	Excavator
Civil	Access Road	Excavation (Cut to Fill)	Pickup Truck
Civil	Access Road	Excavation (Cut to Fill)	Roller
Civil	Access Road	Excavation (Cut to Fill)	Scraper

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Access Road	Excavation (Topsoil Stripping)	Dozer
Civil	Access Road	Fencing	Concrete Truck
Civil	Access Road	Fencing	Dump Truck
Civil	Access Road	Fencing	Other General Equipment
Civil	Access Road	Fencing	Pickup Truck
Civil	Access Road	Fencing	Skid Steer Loader
Civil	Access Road	Fencing	Tractors/Loader/Backhoe
Civil	Access Road	Grading	Dozer
Civil	Access Road	Grading	Grader
Civil	Access Road	Grading	Roller
Civil	Access Road	Hydroseeding	Hydroseeder
Civil	Access Road	Hydroseeding	Off-Road Truck
Civil	Access Road	Markings	Flatbed Truck
Civil	Access Road	Markings	Other General Equipment
Civil	Access Road	Markings	Pickup Truck
Civil	Access Road	Sidewalks	Concrete Truck
Civil	Access Road	Sidewalks	Dump Truck
Civil	Access Road	Sidewalks	Pickup Truck
Civil	Access Road	Sidewalks	Tractors/Loader/Backhoe
Civil	Access Road	Sidewalks	Vibratory Compactor
Civil	Access Road	Soil Erosion/Sediment Control	Other General Equipment
Civil	Access Road	Soil Erosion/Sediment Control	Pickup Truck
Civil	Access Road	Soil Erosion/Sediment Control	Pumps
Civil	Access Road	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Access Road	Street Lighting	Dump Truck
Civil	Access Road	Street Lighting	Loader
Civil	Access Road	Street Lighting	Other General Equipment
Civil	Access Road	Street Lighting	Pickup Truck
Civil	Access Road	Street Lighting	Skid Steer Loader
Civil	Access Road	Street Lighting	Tractors/Loader/Backhoe
Civil	Access Road	Subbase Placement	Dozer
Civil	Access Road	Subbase Placement	Dump Truck (12 cy)
Civil	Access Road	Subbase Placement	Pickup Truck
Civil	Access Road	Subbase Placement	Roller
Civil	Access Road	Topsoil Placement	Dozer
Civil	Access Road	Topsoil Placement	Dump Truck
Civil	Access Road	Topsoil Placement	Pickup Truck
Civil	Access Road	Tree Planting	Flatbed Truck
Civil	Access Road	Tree Planting	Other General Equipment
Civil	Access Road	Tree Planting	Pickup Truck
Civil	Access Road	Tree Planting	Tractors/Loader/Backhoe
Civil	Airfield Lighting	Lighting	Air Compressor
Civil	Airfield Lighting	Lighting	Dump Truck
Civil	Airfield Lighting	Lighting	Loader
Civil	Airfield Lighting	Lighting	Other General Equipment
Civil	Airfield Lighting	Lighting	Pickup Truck
Civil	Airfield Lighting	Lighting	Skid Steer Loader
Civil	Airfield Lighting	Lighting	Tractors/Loader/Backhoe
Civil	Airfield Lighting	Lighting	Trenchers

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Apron (GA)	Asphalt Placement	Asphalt Paver
Civil	Apron (GA)	Asphalt Placement	Dump Truck
Civil	Apron (GA)	Asphalt Placement	Other General Equipment
Civil	Apron (GA)	Asphalt Placement	Pickup Truck
Civil	Apron (GA)	Asphalt Placement	Roller
Civil	Apron (GA)	Asphalt Placement	Skid Steer Loader
Civil	Apron (GA)	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Apron (GA)	Clearing and Grubbing	Chain Saw
Civil	Apron (GA)	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Apron (GA)	Clearing and Grubbing	Pickup Truck
Civil	Apron (GA)	Concrete Placement	Air Compressor
Civil	Apron (GA)	Concrete Placement	Concrete Saws
Civil	Apron (GA)	Concrete Placement	Concrete Truck
Civil	Apron (GA)	Concrete Placement	Other General Equipment
Civil	Apron (GA)	Concrete Placement	Pickup Truck
Civil	Apron (GA)	Concrete Placement	Rubber Tired Loader
Civil	Apron (GA)	Concrete Placement	Slip Form Paver
Civil	Apron (GA)	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Apron (GA)	Drainage - 24 inch SICPP	Dozer
Civil	Apron (GA)	Drainage - 24 inch SICPP	Dump Truck
Civil	Apron (GA)	Drainage - 24 inch SICPP	Excavator
Civil	Apron (GA)	Drainage - 24 inch SICPP	Loader
Civil	Apron (GA)	Drainage - 24 inch SICPP	Other General Equipment
Civil	Apron (GA)	Drainage - 24 inch SICPP	Pickup Truck
Civil	Apron (GA)	Drainage - 24 inch SICPP	Roller
Civil	Apron (GA)	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Apron (GA)	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Apron (GA)	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Apron (GA)	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Apron (GA)	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Apron (GA)	Dust Control	Water Truck
Civil	Apron (GA)	Excavation (Borrow)	Dozer
Civil	Apron (GA)	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Apron (GA)	Excavation (Borrow)	Pickup Truck
Civil	Apron (GA)	Excavation (Borrow)	Roller
Civil	Apron (GA)	Excavation (Cut to Fill)	Dozer
Civil	Apron (GA)	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Apron (GA)	Excavation (Cut to Fill)	Excavator
Civil	Apron (GA)	Excavation (Cut to Fill)	Pickup Truck
Civil	Apron (GA)	Excavation (Cut to Fill)	Roller
Civil	Apron (GA)	Excavation (Cut to Fill)	Scraper
Civil	Apron (GA)	Excavation (Topsoil Stripping)	Dozer
Civil	Apron (GA)	Fencing	Concrete Truck
Civil	Apron (GA)	Fencing	Dump Truck
Civil	Apron (GA)	Fencing	Other General Equipment
Civil	Apron (GA)	Fencing	Pickup Truck
Civil	Apron (GA)	Fencing	Skid Steer Loader
Civil	Apron (GA)	Fencing	Tractors/Loader/Backhoe
Civil	Apron (GA)	Grading	Dozer

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Apron (GA)	Grading	Grader
Civil	Apron (GA)	Grading	Roller
Civil	Apron (GA)	Hydroseeding	Hydroseeder
Civil	Apron (GA)	Hydroseeding	Off-Road Truck
Civil	Apron (GA)	Lighting	Dump Truck
Civil	Apron (GA)	Lighting	Loader
Civil	Apron (GA)	Lighting	Other General Equipment
Civil	Apron (GA)	Lighting	Pickup Truck
Civil	Apron (GA)	Lighting	Skid Steer Loader
Civil	Apron (GA)	Lighting	Tractors/Loader/Backhoe
Civil	Apron (GA)	Markings	Flatbed Truck
Civil	Apron (GA)	Markings	Other General Equipment
Civil	Apron (GA)	Markings	Pickup Truck
Civil	Apron (GA)	Sealing/Fuel Resistant	Distributing Tanker
Civil	Apron (GA)	Sealing/Fuel Resistant	Other General Equipment
Civil	Apron (GA)	Sealing/Fuel Resistant	Pickup Truck
Civil	Apron (GA)	Soil Erosion/Sediment Control	Other General Equipment
Civil	Apron (GA)	Soil Erosion/Sediment Control	Pickup Truck
Civil	Apron (GA)	Soil Erosion/Sediment Control	Pumps
Civil	Apron (GA)	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Apron (GA)	Subbase Placement	Dozer
Civil	Apron (GA)	Subbase Placement	Dump Truck (12 cy)
Civil	Apron (GA)	Subbase Placement	Pickup Truck
Civil	Apron (GA)	Subbase Placement	Roller
Civil	Apron (GA)	Topsoil Placement	Dozer
Civil	Apron (GA)	Topsoil Placement	Dump Truck
Civil	Apron (GA)	Topsoil Placement	Pickup Truck
Civil	Cargo Apron	Asphalt Placement	Asphalt Paver
Civil	Cargo Apron	Asphalt Placement	Dump Truck
Civil	Cargo Apron	Asphalt Placement	Other General Equipment
Civil	Cargo Apron	Asphalt Placement	Pickup Truck
Civil	Cargo Apron	Asphalt Placement	Roller
Civil	Cargo Apron	Asphalt Placement	Skid Steer Loader
Civil	Cargo Apron	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Cargo Apron	Clearing and Grubbing	Chain Saw
Civil	Cargo Apron	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Cargo Apron	Clearing and Grubbing	Pickup Truck
Civil	Cargo Apron	Concrete Placement	Air Compressor
Civil	Cargo Apron	Concrete Placement	Concrete Saws
Civil	Cargo Apron	Concrete Placement	Concrete Truck
Civil	Cargo Apron	Concrete Placement	Other General Equipment
Civil	Cargo Apron	Concrete Placement	Pickup Truck
Civil	Cargo Apron	Concrete Placement	Rubber Tired Loader
Civil	Cargo Apron	Concrete Placement	Slip Form Paver
Civil	Cargo Apron	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Cargo Apron	Drainage - 24 inch SICPP	Dozer
Civil	Cargo Apron	Drainage - 24 inch SICPP	Dump Truck
Civil	Cargo Apron	Drainage - 24 inch SICPP	Excavator
Civil	Cargo Apron	Drainage - 24 inch SICPP	Loader

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Cargo Apron	Drainage - 24 inch SICPP	Other General Equipment
Civil	Cargo Apron	Drainage - 24 inch SICPP	Pickup Truck
Civil	Cargo Apron	Drainage - 24 inch SICPP	Roller
Civil	Cargo Apron	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Cargo Apron	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Cargo Apron	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Cargo Apron	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Cargo Apron	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Cargo Apron	Dust Control	Water Truck
Civil	Cargo Apron	Excavation (Borrow)	Dozer
Civil	Cargo Apron	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Cargo Apron	Excavation (Borrow)	Pickup Truck
Civil	Cargo Apron	Excavation (Borrow)	Roller
Civil	Cargo Apron	Excavation (Cut to Fill)	Dozer
Civil	Cargo Apron	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Cargo Apron	Excavation (Cut to Fill)	Excavator
Civil	Cargo Apron	Excavation (Cut to Fill)	Pickup Truck
Civil	Cargo Apron	Excavation (Cut to Fill)	Roller
Civil	Cargo Apron	Excavation (Cut to Fill)	Scraper
Civil	Cargo Apron	Excavation (Topsoil Stripping)	Dozer
Civil	Cargo Apron	Fencing	Concrete Truck
Civil	Cargo Apron	Fencing	Dump Truck
Civil	Cargo Apron	Fencing	Other General Equipment
Civil	Cargo Apron	Fencing	Pickup Truck
Civil	Cargo Apron	Fencing	Skid Steer Loader
Civil	Cargo Apron	Fencing	Tractors/Loader/Backhoe
Civil	Cargo Apron	Grading	Dozer
Civil	Cargo Apron	Grading	Grader
Civil	Cargo Apron	Grading	Roller
Civil	Cargo Apron	Hydroseeding	Hydroseeder
Civil	Cargo Apron	Hydroseeding	Off-Road Truck
Civil	Cargo Apron	Lighting	Dump Truck
Civil	Cargo Apron	Lighting	Loader
Civil	Cargo Apron	Lighting	Other General Equipment
Civil	Cargo Apron	Lighting	Pickup Truck
Civil	Cargo Apron	Lighting	Skid Steer Loader
Civil	Cargo Apron	Lighting	Tractors/Loader/Backhoe
Civil	Cargo Apron	Markings	Flatbed Truck
Civil	Cargo Apron	Markings	Other General Equipment
Civil	Cargo Apron	Markings	Pickup Truck
Civil	Cargo Apron	Sealing/Fuel Resistant	Distributing Tanker
Civil	Cargo Apron	Sealing/Fuel Resistant	Other General Equipment
Civil	Cargo Apron	Sealing/Fuel Resistant	Pickup Truck
Civil	Cargo Apron	Soil Erosion/Sediment Control	Other General Equipment
Civil	Cargo Apron	Soil Erosion/Sediment Control	Pickup Truck
Civil	Cargo Apron	Soil Erosion/Sediment Control	Pumps
Civil	Cargo Apron	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Cargo Apron	Subbase Placement	Dozer
Civil	Cargo Apron	Subbase Placement	Dump Truck (12 cy)

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Cargo Apron	Subbase Placement	Pickup Truck
Civil	Cargo Apron	Subbase Placement	Roller
Civil	Cargo Apron	Topsoil Placement	Dozer
Civil	Cargo Apron	Topsoil Placement	Dump Truck
Civil	Cargo Apron	Topsoil Placement	Pickup Truck
Civil	Detention Basin	Clearing and Grubbing	Chain Saw
Civil	Detention Basin	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Detention Basin	Clearing and Grubbing	Pickup Truck
Civil	Detention Basin	Drainage	Dozer
Civil	Detention Basin	Drainage	Dump Truck
Civil	Detention Basin	Drainage	Loader
Civil	Detention Basin	Drainage	Other General Equipment
Civil	Detention Basin	Drainage	Pickup Truck
Civil	Detention Basin	Drainage	Roller
Civil	Detention Basin	Drainage - 24 inch SICPP	Excavator
Civil	Detention Basin	Dust Control	Water Truck
Civil	Detention Basin	Excavation (Cut to Fill)	Dozer
Civil	Detention Basin	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Detention Basin	Excavation (Cut to Fill)	Excavator
Civil	Detention Basin	Excavation (Cut to Fill)	Pickup Truck
Civil	Detention Basin	Excavation (Cut to Fill)	Roller
Civil	Detention Basin	Excavation (Cut to Fill)	Scraper
Civil	Detention Basin	Excavation (Topsoil Stripping)	Dozer
Civil	Detention Basin	Fencing	Concrete Truck
Civil	Detention Basin	Fencing	Dump Truck
Civil	Detention Basin	Fencing	Other General Equipment
Civil	Detention Basin	Fencing	Pickup Truck
Civil	Detention Basin	Fencing	Skid Steer Loader
Civil	Detention Basin	Fencing	Tractors/Loader/Backhoe
Civil	Detention Basin	Hydroseeding	Hydroseeder
Civil	Detention Basin	Hydroseeding	Off-Road Truck
Civil	Detention Basin	Soil Erosion/Sediment Control	Other General Equipment
Civil	Detention Basin	Soil Erosion/Sediment Control	Pickup Truck
Civil	Detention Basin	Soil Erosion/Sediment Control	Pumps
Civil	Detention Basin	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Detention Basin	Topsoil Placement	Dozer
Civil	Detention Basin	Topsoil Placement	Dump Truck
Civil	Detention Basin	Topsoil Placement	Pickup Truck
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Dozer
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Dump Truck
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Excavator
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Loader
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Other General Equipment
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Pickup Truck
Civil	Drainage System	Drainage - 24 inch Reinforced Concrete Pipe	Roller

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Drainage System	Drainage - 24 inch SICPP	Dozer
Civil	Drainage System	Drainage - 24 inch SICPP	Dump Truck
Civil	Drainage System	Drainage - 24 inch SICPP	Excavator
Civil	Drainage System	Drainage - 24 inch SICPP	Loader
Civil	Drainage System	Drainage - 24 inch SICPP	Other General Equipment
Civil	Drainage System	Drainage - 24 inch SICPP	Pickup Truck
Civil	Drainage System	Drainage - 24 inch SICPP	Roller
Civil	Drainage System	Drainage Structures	Dump Truck
Civil	Drainage System	Drainage Structures	Excavator
Civil	Drainage System	Drainage Structures	Other General Equipment
Civil	Drainage System	Drainage Structures	Pickup Truck
Civil	Drainage System	Hydroseeding	Hydroseeder
Civil	Drainage System	Hydroseeding	Off-Road Truck
Civil	Drainage System	Soil Erosion/Sediment Control	Other General Equipment
Civil	Drainage System	Soil Erosion/Sediment Control	Pickup Truck
Civil	Drainage System	Soil Erosion/Sediment Control	Pumps
Civil	Drainage System	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Drainage System	Topsoil Placement	Dozer
Civil	Drainage System	Topsoil Placement	Dump Truck
Civil	Drainage System	Topsoil Placement	Pickup Truck
Civil	Fencing	Clearing and Grubbing	Chain Saw
Civil	Fencing	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Fencing	Clearing and Grubbing	Pickup Truck
Civil	Fencing	Excavation (Cut to Fill)	Dozer
Civil	Fencing	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Fencing	Excavation (Cut to Fill)	Excavator
Civil	Fencing	Excavation (Cut to Fill)	Pickup Truck
Civil	Fencing	Excavation (Cut to Fill)	Roller
Civil	Fencing	Fencing	Concrete Truck
Civil	Fencing	Fencing	Dump Truck
Civil	Fencing	Fencing	Other General Equipment
Civil	Fencing	Fencing	Pickup Truck
Civil	Fencing	Fencing	Skid Steer Loader
Civil	Fencing	Fencing	Tractors/Loader/Backhoe
Civil	Fencing	Grading	Dozer
Civil	Fencing	Grading	Grader
Civil	Fencing	Grading	Roller
Civil	Fencing	Hydroseeding	Hydroseeder
Civil	Fencing	Hydroseeding	Off-Road Truck
Civil	Fencing	Soil Erosion/Sediment Control	Other General Equipment
Civil	Fencing	Soil Erosion/Sediment Control	Pickup Truck
Civil	Fencing	Soil Erosion/Sediment Control	Pumps
Civil	Fencing	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Fencing	Topsoil Placement	Dozer
Civil	Fencing	Topsoil Placement	Dump Truck
Civil	Fencing	Topsoil Placement	Pickup Truck
Civil	Fuel Tanks	Asphalt Placement	Asphalt Paver
Civil	Fuel Tanks	Asphalt Placement	Dump Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Fuel Tanks	Asphalt Placement	Other General Equipment
Civil	Fuel Tanks	Asphalt Placement	Pickup Truck
Civil	Fuel Tanks	Asphalt Placement	Roller
Civil	Fuel Tanks	Asphalt Placement	Skid Steer Loader
Civil	Fuel Tanks	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Fuel Tanks	Clearing and Grubbing	Chain Saw
Civil	Fuel Tanks	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Fuel Tanks	Clearing and Grubbing	Pickup Truck
Civil	Fuel Tanks	Concrete Placement	Air Compressor
Civil	Fuel Tanks	Concrete Placement	Concrete Saws
Civil	Fuel Tanks	Concrete Placement	Concrete Truck
Civil	Fuel Tanks	Concrete Placement	Other General Equipment
Civil	Fuel Tanks	Concrete Placement	Pickup Truck
Civil	Fuel Tanks	Concrete Placement	Rubber Tired Loader
Civil	Fuel Tanks	Concrete Placement	Slip Form Paver
Civil	Fuel Tanks	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Fuel Tanks	Construction/Erect Tanks	Crane
Civil	Fuel Tanks	Construction/Erect Tanks	Other General Equipment
Civil	Fuel Tanks	Construction/Erect Tanks	Pickup Truck
Civil	Fuel Tanks	Drainage	Dozer
Civil	Fuel Tanks	Drainage	Dump Truck
Civil	Fuel Tanks	Drainage	Loader
Civil	Fuel Tanks	Drainage	Other General Equipment
Civil	Fuel Tanks	Drainage	Pickup Truck
Civil	Fuel Tanks	Drainage	Roller
Civil	Fuel Tanks	Drainage - 24 inch SICPP	Excavator
Civil	Fuel Tanks	Dust Control	Water Truck
Civil	Fuel Tanks	Excavation (Borrow)	Dozer
Civil	Fuel Tanks	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Fuel Tanks	Excavation (Borrow)	Pickup Truck
Civil	Fuel Tanks	Excavation (Borrow)	Roller
Civil	Fuel Tanks	Excavation (Cut to Fill)	Dozer
Civil	Fuel Tanks	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Fuel Tanks	Excavation (Cut to Fill)	Excavator
Civil	Fuel Tanks	Excavation (Cut to Fill)	Pickup Truck
Civil	Fuel Tanks	Excavation (Cut to Fill)	Roller
Civil	Fuel Tanks	Excavation (Cut to Fill)	Scraper
Civil	Fuel Tanks	Excavation (Topsoil Stripping)	Dozer
Civil	Fuel Tanks	Fencing	Concrete Truck
Civil	Fuel Tanks	Fencing	Dump Truck
Civil	Fuel Tanks	Fencing	Other General Equipment
Civil	Fuel Tanks	Fencing	Pickup Truck
Civil	Fuel Tanks	Fencing	Skid Steer Loader
Civil	Fuel Tanks	Fencing	Tractors/Loader/Backhoe
Civil	Fuel Tanks	Grading	Dozer
Civil	Fuel Tanks	Grading	Grader
Civil	Fuel Tanks	Grading	Roller
Civil	Fuel Tanks	Hydroseeding	Hydroseeder
Civil	Fuel Tanks	Hydroseeding	Off-Road Truck

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Fuel Tanks	Markings	Flatbed Truck
Civil	Fuel Tanks	Markings	Other General Equipment
Civil	Fuel Tanks	Markings	Pickup Truck
Civil	Fuel Tanks	Soil Erosion/Sediment Control	Other General Equipment
Civil	Fuel Tanks	Soil Erosion/Sediment Control	Pickup Truck
Civil	Fuel Tanks	Soil Erosion/Sediment Control	Pumps
Civil	Fuel Tanks	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Fuel Tanks	Street Lighting	Dump Truck
Civil	Fuel Tanks	Street Lighting	Loader
Civil	Fuel Tanks	Street Lighting	Other General Equipment
Civil	Fuel Tanks	Street Lighting	Pickup Truck
Civil	Fuel Tanks	Street Lighting	Skid Steer Loader
Civil	Fuel Tanks	Street Lighting	Tractors/Loader/Backhoe
Civil	Fuel Tanks	Subbase Placement	Dozer
Civil	Fuel Tanks	Subbase Placement	Dump Truck (12 cy)
Civil	Fuel Tanks	Subbase Placement	Pickup Truck
Civil	Fuel Tanks	Subbase Placement	Roller
Civil	Fuel Tanks	Topsoil Placement	Dozer
Civil	Fuel Tanks	Topsoil Placement	Dump Truck
Civil	Fuel Tanks	Topsoil Placement	Pickup Truck
Civil	Helipad	Asphalt Placement	Asphalt Paver
Civil	Helipad	Asphalt Placement	Dump Truck
Civil	Helipad	Asphalt Placement	Other General Equipment
Civil	Helipad	Asphalt Placement	Pickup Truck
Civil	Helipad	Asphalt Placement	Roller
Civil	Helipad	Asphalt Placement	Skid Steer Loader
Civil	Helipad	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Helipad	Clearing and Grubbing	Chain Saw
Civil	Helipad	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Helipad	Clearing and Grubbing	Pickup Truck
Civil	Helipad	Concrete Placement	Air Compressor
Civil	Helipad	Concrete Placement	Concrete Saws
Civil	Helipad	Concrete Placement	Concrete Truck
Civil	Helipad	Concrete Placement	Other General Equipment
Civil	Helipad	Concrete Placement	Pickup Truck
Civil	Helipad	Concrete Placement	Rubber Tired Loader
Civil	Helipad	Concrete Placement	Slip Form Paver
Civil	Helipad	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Helipad	Drainage - 24 inch SICPP	Dozer
Civil	Helipad	Drainage - 24 inch SICPP	Dump Truck
Civil	Helipad	Drainage - 24 inch SICPP	Excavator
Civil	Helipad	Drainage - 24 inch SICPP	Loader
Civil	Helipad	Drainage - 24 inch SICPP	Other General Equipment
Civil	Helipad	Drainage - 24 inch SICPP	Pickup Truck
Civil	Helipad	Drainage - 24 inch SICPP	Roller
Civil	Helipad	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Helipad	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Helipad	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Helipad	Drainage - 6 inch Perforated Underdrain	Pickup Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Helipad	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Helipad	Dust Control	Water Truck
Civil	Helipad	Excavation (Borrow)	Dozer
Civil	Helipad	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Helipad	Excavation (Borrow)	Pickup Truck
Civil	Helipad	Excavation (Borrow)	Roller
Civil	Helipad	Excavation (Cut to Fill)	Dozer
Civil	Helipad	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Helipad	Excavation (Cut to Fill)	Excavator
Civil	Helipad	Excavation (Cut to Fill)	Pickup Truck
Civil	Helipad	Excavation (Cut to Fill)	Roller
Civil	Helipad	Excavation (Topsoil Stripping)	Dozer
Civil	Helipad	Fencing	Concrete Truck
Civil	Helipad	Fencing	Dump Truck
Civil	Helipad	Fencing	Other General Equipment
Civil	Helipad	Fencing	Pickup Truck
Civil	Helipad	Fencing	Skid Steer Loader
Civil	Helipad	Fencing	Tractors/Loader/Backhoe
Civil	Helipad	Grading	Dozer
Civil	Helipad	Grading	Grader
Civil	Helipad	Grading	Roller
Civil	Helipad	Hydroseeding	Hydroseeder
Civil	Helipad	Hydroseeding	Off-Road Truck
Civil	Helipad	Lighting	Dump Truck
Civil	Helipad	Lighting	Loader
Civil	Helipad	Lighting	Other General Equipment
Civil	Helipad	Lighting	Pickup Truck
Civil	Helipad	Lighting	Skid Steer Loader
Civil	Helipad	Lighting	Tractors/Loader/Backhoe
Civil	Helipad	Markings	Flatbed Truck
Civil	Helipad	Markings	Other General Equipment
Civil	Helipad	Markings	Pickup Truck
Civil	Helipad	Soil Erosion/Sediment Control	Other General Equipment
Civil	Helipad	Soil Erosion/Sediment Control	Pickup Truck
Civil	Helipad	Soil Erosion/Sediment Control	Pumps
Civil	Helipad	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Helipad	Subbase Placement	Dozer
Civil	Helipad	Subbase Placement	Dump Truck (12 cy)
Civil	Helipad	Subbase Placement	Pickup Truck
Civil	Helipad	Subbase Placement	Roller
Civil	Helipad	Topsoil Placement	Dozer
Civil	Helipad	Topsoil Placement	Dump Truck
Civil	Helipad	Topsoil Placement	Pickup Truck
Civil	Landscaping	Hydroseeding	Hydroseeder
Civil	Landscaping	Hydroseeding	Off-Road Truck
Civil	Landscaping	Mulching	Dump Truck
Civil	Landscaping	Mulching	Other General Equipment
Civil	Landscaping	Mulching	Pickup Truck
Civil	Landscaping	Mulching	Tractors/Loader/Backhoe

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Landscaping	Sodding	Flatbed Truck
Civil	Landscaping	Sodding	Other General Equipment
Civil	Landscaping	Sodding	Pickup Truck
Civil	Landscaping	Sodding	Skid Steer Loader
Civil	Landscaping	Topsoil Placement	Dozer
Civil	Landscaping	Topsoil Placement	Dump Truck
Civil	Landscaping	Topsoil Placement	Pickup Truck
Civil	Landscaping	Tree Planting	Flatbed Truck
Civil	Landscaping	Tree Planting	Other General Equipment
Civil	Landscaping	Tree Planting	Pickup Truck
Civil	Landscaping	Tree Planting	Tractors/Loader/Backhoe
Civil	Landscaping	Tree Pruning	Aerial Lift
Civil	Landscaping	Tree Pruning	Chipper/Stump Grinder
Civil	Landscaping	Tree Pruning	Dump Truck
Civil	Landscaping	Tree Pruning	Other General Equipment
Civil	Landscaping	Tree Pruning	Pickup Truck
Civil	Landscaping	Tree Pruning	Pruning Saw/Chain Saw
Civil	NAVAIDS	Approach Lighting	Air Compressor
Civil	NAVAIDS	Approach Lighting	Crane
Civil	NAVAIDS	Approach Lighting	Dozer
Civil	NAVAIDS	Approach Lighting	Dump Truck
Civil	NAVAIDS	Approach Lighting	Excavator
Civil	NAVAIDS	Approach Lighting	Other General Equipment
Civil	NAVAIDS	Approach Lighting	Skid Steer Loader
Civil	NAVAIDS	Approach Lighting	Tractors/Loader/Backhoe
Civil	NAVAIDS	Clearing and Grubbing with approach lighting	Chain Saw
Civil	NAVAIDS	Clearing and Grubbing with approach lighting	Chipper/Stump Grinder
Civil	NAVAIDS	Clearing and Grubbing with approach lighting	Pickup Truck
Civil	NAVAIDS	ILS Glide Slope	Air Compressor
Civil	NAVAIDS	ILS Glide Slope	Crane
Civil	NAVAIDS	ILS Glide Slope	Dozer
Civil	NAVAIDS	ILS Glide Slope	Dump Truck
Civil	NAVAIDS	ILS Glide Slope	Excavator
Civil	NAVAIDS	ILS Glide Slope	Other General Equipment
Civil	NAVAIDS	ILS Glide Slope	Pickup Truck
Civil	NAVAIDS	ILS Glide Slope	Skid Steer Loader
Civil	NAVAIDS	ILS Glide Slope	Tractors/Loader/Backhoe
Civil	NAVAIDS	ILS Localizer	Air Compressor
Civil	NAVAIDS	ILS Localizer	Crane
Civil	NAVAIDS	ILS Localizer	Dozer
Civil	NAVAIDS	ILS Localizer	Dump Truck
Civil	NAVAIDS	ILS Localizer	Excavator
Civil	NAVAIDS	ILS Localizer	Other General Equipment
Civil	NAVAIDS	ILS Localizer	Pickup Truck
Civil	NAVAIDS	ILS Localizer	Skid Steer Loader
Civil	NAVAIDS	ILS Localizer	Tractors/Loader/Backhoe
Civil	NAVAIDS	PAPI	Air Compressor

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	NAVAIDS	PAPI	Dump Truck
Civil	NAVAIDS	PAPI	Other General Equipment
Civil	NAVAIDS	PAPI	Pickup Truck
Civil	NAVAIDS	PAPI	Skid Steer Loader
Civil	NAVAIDS	PAPI	Tractors/Loader/Backhoe
Civil	NAVAIDS	Rotating Beacon	Crane
Civil	NAVAIDS	Rotating Beacon	Dump Truck
Civil	NAVAIDS	Rotating Beacon	Excavator
Civil	NAVAIDS	Rotating Beacon	Other General Equipment
Civil	NAVAIDS	Rotating Beacon	Pickup Truck
Civil	NAVAIDS	Windcone	Dump Truck
Civil	NAVAIDS	Windcone	Excavator
Civil	NAVAIDS	Windcone	Other General Equipment
Civil	NAVAIDS	Windcone	Pickup Truck
Civil	New Runway	Asphalt Placement	Asphalt Paver
Civil	New Runway	Asphalt Placement	Dump Truck
Civil	New Runway	Asphalt Placement	Other General Equipment
Civil	New Runway	Asphalt Placement	Pickup Truck
Civil	New Runway	Asphalt Placement	Roller
Civil	New Runway	Asphalt Placement	Skid Steer Loader
Civil	New Runway	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	New Runway	Clearing and Grubbing	Chain Saw
Civil	New Runway	Clearing and Grubbing	Chipper/Stump Grinder
Civil	New Runway	Clearing and Grubbing	Pickup Truck
Civil	New Runway	Concrete Placement	Air Compressor
Civil	New Runway	Concrete Placement	Concrete Saws
Civil	New Runway	Concrete Placement	Concrete Truck
Civil	New Runway	Concrete Placement	Other General Equipment
Civil	New Runway	Concrete Placement	Pickup Truck
Civil	New Runway	Concrete Placement	Rubber Tired Loader
Civil	New Runway	Concrete Placement	Slip Form Paver
Civil	New Runway	Concrete Placement	Surfacing Equipment (Grooving)
Civil	New Runway	Drainage - 24 inch SICPP	Dozer
Civil	New Runway	Drainage - 24 inch SICPP	Dump Truck
Civil	New Runway	Drainage - 24 inch SICPP	Excavator
Civil	New Runway	Drainage - 24 inch SICPP	Loader
Civil	New Runway	Drainage - 24 inch SICPP	Other General Equipment
Civil	New Runway	Drainage - 24 inch SICPP	Pickup Truck
Civil	New Runway	Drainage - 24 inch SICPP	Roller
Civil	New Runway	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	New Runway	Drainage - 6 inch Perforated Underdrain	Loader
Civil	New Runway	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	New Runway	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	New Runway	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	New Runway	Dust Control	Water Truck
Civil	New Runway	Excavation (Borrow)	Dozer
Civil	New Runway	Excavation (Borrow)	Dump Truck (12 cy)
Civil	New Runway	Excavation (Borrow)	Pickup Truck
Civil	New Runway	Excavation (Borrow)	Roller

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	New Runway	Excavation (Cut to Fill)	Dozer
Civil	New Runway	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	New Runway	Excavation (Cut to Fill)	Excavator
Civil	New Runway	Excavation (Cut to Fill)	Pickup Truck
Civil	New Runway	Excavation (Cut to Fill)	Roller
Civil	New Runway	Excavation (Cut to Fill)	Scraper
Civil	New Runway	Excavation (Topsoil Stripping)	Dozer
Civil	New Runway	Fencing	Concrete Truck
Civil	New Runway	Fencing	Dump Truck
Civil	New Runway	Fencing	Other General Equipment
Civil	New Runway	Fencing	Pickup Truck
Civil	New Runway	Fencing	Skid Steer Loader
Civil	New Runway	Fencing	Tractors/Loader/Backhoe
Civil	New Runway	Grading	Dozer
Civil	New Runway	Grading	Grader
Civil	New Runway	Grading	Roller
Civil	New Runway	Hydroseeding	Hydroseeder
Civil	New Runway	Hydroseeding	Off-Road Truck
Civil	New Runway	Lighting	Dump Truck
Civil	New Runway	Lighting	Loader
Civil	New Runway	Lighting	Other General Equipment
Civil	New Runway	Lighting	Pickup Truck
Civil	New Runway	Lighting	Skid Steer Loader
Civil	New Runway	Lighting	Tractors/Loader/Backhoe
Civil	New Runway	Markings	Flatbed Truck
Civil	New Runway	Markings	Other General Equipment
Civil	New Runway	Markings	Pickup Truck
Civil	New Runway	Soil Erosion/Control	Other General Equipment
Civil	New Runway	Soil Erosion/Control	Pickup Truck
Civil	New Runway	Soil Erosion/Control	Pumps
Civil	New Runway	Soil Erosion/Control	Tractors/Loader/Backhoe
Civil	New Runway	Subbase Placement	Dozer
Civil	New Runway	Subbase Placement	Dump Truck (12 cy)
Civil	New Runway	Subbase Placement	Pickup Truck
Civil	New Runway	Subbase Placement	Roller
Civil	New Runway	Topsoil Placement	Dozer
Civil	New Runway	Topsoil Placement	Dump Truck
Civil	New Runway	Topsoil Placement	Pickup Truck
Civil	Noise Barrier	Clearing and Grubbing	Chain Saw
Civil	Noise Barrier	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Noise Barrier	Clearing and Grubbing	Pickup Truck
Civil	Noise Barrier	Concrete Placement	Air Compressor
Civil	Noise Barrier	Concrete Placement	Concrete Truck
Civil	Noise Barrier	Concrete Placement	Crane
Civil	Noise Barrier	Concrete Placement	Crane w/ Concrete Pump
Civil	Noise Barrier	Concrete Placement	Other General Equipment
Civil	Noise Barrier	Concrete Placement	Pickup Truck
Civil	Noise Barrier	Concrete Placement	Rubber Tired Loader
Civil	Noise Barrier	Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile	Air Compressor

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Noise Barrier	Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile	Concrete Saws
Civil	Noise Barrier	Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile	Other General Equipment
Civil	Noise Barrier	Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile	Pickup Truck
Civil	Noise Barrier	Concrete Placement - 8 CY; 20 MPH Average; Cycle 2 mile	Rubber Tired Loader
Civil	Noise Barrier	Drainage	Dozer
Civil	Noise Barrier	Drainage	Dump Truck
Civil	Noise Barrier	Drainage	Loader
Civil	Noise Barrier	Drainage	Other General Equipment
Civil	Noise Barrier	Drainage	Pickup Truck
Civil	Noise Barrier	Drainage	Roller
Civil	Noise Barrier	Drainage - 24 inch SICPP	Excavator
Civil	Noise Barrier	Dust Control	Water Truck
Civil	Noise Barrier	Excavation (Borrow)	Dozer
Civil	Noise Barrier	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Noise Barrier	Excavation (Borrow)	Pickup Truck
Civil	Noise Barrier	Excavation (Borrow)	Roller
Civil	Noise Barrier	Excavation (Cut to Fill)	Dozer
Civil	Noise Barrier	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Noise Barrier	Excavation (Cut to Fill)	Excavator
Civil	Noise Barrier	Excavation (Cut to Fill)	Pickup Truck
Civil	Noise Barrier	Excavation (Cut to Fill)	Roller
Civil	Noise Barrier	Excavation (Cut to Fill)	Scraper
Civil	Noise Barrier	Excavation (Topsoil Stripping)	Dozer
Civil	Noise Barrier	Grading	Dozer
Civil	Noise Barrier	Grading	Grader
Civil	Noise Barrier	Grading	Roller
Civil	Noise Barrier	Hydroseeding	Hydroseeder
Civil	Noise Barrier	Hydroseeding	Off-Road Truck
Civil	Noise Barrier	Soil Erosion/Sediment Control	Other General Equipment
Civil	Noise Barrier	Soil Erosion/Sediment Control	Pickup Truck
Civil	Noise Barrier	Soil Erosion/Sediment Control	Pumps
Civil	Noise Barrier	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Noise Barrier	Subbase Placement	Dozer
Civil	Noise Barrier	Subbase Placement	Dump Truck (12 cy)
Civil	Noise Barrier	Subbase Placement	Pickup Truck
Civil	Noise Barrier	Subbase Placement	Roller
Civil	Noise Barrier	Topsoil Placement	Dozer
Civil	Noise Barrier	Topsoil Placement	Dump Truck
Civil	Noise Barrier	Topsoil Placement	Pickup Truck
Civil	Parking Lot	Asphalt Placement	Asphalt Paver
Civil	Parking Lot	Asphalt Placement	Dump Truck
Civil	Parking Lot	Asphalt Placement	Other General Equipment
Civil	Parking Lot	Asphalt Placement	Pickup Truck
Civil	Parking Lot	Asphalt Placement	Roller
Civil	Parking Lot	Asphalt Placement	Skid Steer Loader
Civil	Parking Lot	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Parking Lot	Clearing and Grubbing	Chain Saw

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Parking Lot	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Parking Lot	Clearing and Grubbing	Pickup Truck
Civil	Parking Lot	Concrete Placement	Air Compressor
Civil	Parking Lot	Concrete Placement	Concrete Saws
Civil	Parking Lot	Concrete Placement	Concrete Truck
Civil	Parking Lot	Concrete Placement	Other General Equipment
Civil	Parking Lot	Concrete Placement	Pickup Truck
Civil	Parking Lot	Concrete Placement	Rubber Tired Loader
Civil	Parking Lot	Concrete Placement	Slip Form Paver
Civil	Parking Lot	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Parking Lot	Curbing	Concrete Truck
Civil	Parking Lot	Curbing	Curb/Gutter Paver
Civil	Parking Lot	Curbing	Other General Equipment
Civil	Parking Lot	Curbing	Pickup Truck
Civil	Parking Lot	Drainage - 24 inch SICPP	Dozer
Civil	Parking Lot	Drainage - 24 inch SICPP	Dump Truck
Civil	Parking Lot	Drainage - 24 inch SICPP	Excavator
Civil	Parking Lot	Drainage - 24 inch SICPP	Loader
Civil	Parking Lot	Drainage - 24 inch SICPP	Other General Equipment
Civil	Parking Lot	Drainage - 24 inch SICPP	Pickup Truck
Civil	Parking Lot	Drainage - 24 inch SICPP	Roller
Civil	Parking Lot	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Parking Lot	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Parking Lot	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Parking Lot	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Parking Lot	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Parking Lot	Excavation (Borrow)	Dozer
Civil	Parking Lot	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Parking Lot	Excavation (Borrow)	Pickup Truck
Civil	Parking Lot	Excavation (Borrow)	Roller
Civil	Parking Lot	Excavation (Cut to Fill)	Dozer
Civil	Parking Lot	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Parking Lot	Excavation (Cut to Fill)	Excavator
Civil	Parking Lot	Excavation (Cut to Fill)	Pickup Truck
Civil	Parking Lot	Excavation (Cut to Fill)	Roller
Civil	Parking Lot	Excavation (Cut to Fill)	Scraper
Civil	Parking Lot	Excavation (Topsoil Stripping)	Dozer
Civil	Parking Lot	Fencing	Concrete Truck
Civil	Parking Lot	Fencing	Dump Truck
Civil	Parking Lot	Fencing	Other General Equipment
Civil	Parking Lot	Fencing	Pickup Truck
Civil	Parking Lot	Fencing	Skid Steer Loader
Civil	Parking Lot	Fencing	Tractors/Loader/Backhoe
Civil	Parking Lot	Grading	Dozer
Civil	Parking Lot	Grading	Grader
Civil	Parking Lot	Grading	Roller
Civil	Parking Lot	Hydroseeding	Hydroseeder
Civil	Parking Lot	Hydroseeding	Off-Road Truck
Civil	Parking Lot	Markings	Flatbed Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Parking Lot	Markings	Other General Equipment
Civil	Parking Lot	Markings	Pickup Truck
Civil	Parking Lot	Sidewalks	Concrete Truck
Civil	Parking Lot	Sidewalks	Dump Truck
Civil	Parking Lot	Sidewalks	Pickup Truck
Civil	Parking Lot	Sidewalks	Tractors/Loader/Backhoe
Civil	Parking Lot	Sidewalks	Vibratory Compactor
Civil	Parking Lot	Soil Erosion/Sediment Control	Other General Equipment
Civil	Parking Lot	Soil Erosion/Sediment Control	Pickup Truck
Civil	Parking Lot	Soil Erosion/Sediment Control	Pumps
Civil	Parking Lot	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Parking Lot	Street Lighting	Dump Truck
Civil	Parking Lot	Street Lighting	Loader
Civil	Parking Lot	Street Lighting	Other General Equipment
Civil	Parking Lot	Street Lighting	Pickup Truck
Civil	Parking Lot	Street Lighting	Skid Steer Loader
Civil	Parking Lot	Street Lighting	Tractors/Loader/Backhoe
Civil	Parking Lot	Subbase Placement	Dozer
Civil	Parking Lot	Subbase Placement	Dump Truck (12 cy)
Civil	Parking Lot	Subbase Placement	Pickup Truck
Civil	Parking Lot	Subbase Placement	Roller
Civil	Parking Lot	Topsoil Placement	Dozer
Civil	Parking Lot	Topsoil Placement	Dump Truck
Civil	Parking Lot	Topsoil Placement	Pickup Truck
Civil	Parking Lot	Tree Planting	Flatbed Truck
Civil	Parking Lot	Tree Planting	Other General Equipment
Civil	Parking Lot	Tree Planting	Pickup Truck
Civil	Parking Lot	Tree Planting	Tractors/Loader/Backhoe
Civil	Rehabilitate Runway	Asphalt Placement	Asphalt Paver
Civil	Rehabilitate Runway	Asphalt Placement	Dump Truck
Civil	Rehabilitate Runway	Asphalt Placement	Other General Equipment
Civil	Rehabilitate Runway	Asphalt Placement	Pickup Truck
Civil	Rehabilitate Runway	Asphalt Placement	Roller
Civil	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader
Civil	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Rehabilitate Runway	Cold Milling	Cold Planer
Civil	Rehabilitate Runway	Cold Milling	Dump Truck
Civil	Rehabilitate Runway	Cold Milling	Pickup Truck
Civil	Rehabilitate Runway	Cold Milling	Sweepers
Civil	Rehabilitate Runway	Cold Milling	Water Truck
Civil	Rehabilitate Runway	Concrete Demolition	Concrete Saws
Civil	Rehabilitate Runway	Concrete Demolition	Dump Truck
Civil	Rehabilitate Runway	Concrete Demolition	Excavator
Civil	Rehabilitate Runway	Concrete Demolition	Hydraulic Hammer
Civil	Rehabilitate Runway	Concrete Demolition	Other General Equipment
Civil	Rehabilitate Runway	Concrete Demolition	Pickup Truck
Civil	Rehabilitate Runway	Concrete Placement	Air Compressor
Civil	Rehabilitate Runway	Concrete Placement	Concrete Saws
Civil	Rehabilitate Runway	Concrete Placement	Concrete Truck

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Rehabilitate Runway	Concrete Placement	Other General Equipment
Civil	Rehabilitate Runway	Concrete Placement	Pickup Truck
Civil	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader
Civil	Rehabilitate Runway	Concrete Placement	Slip Form Paver
Civil	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Rehabilitate Runway	Dust Control	Water Truck
Civil	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer
Civil	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)
Civil	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator
Civil	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck
Civil	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller
Civil	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer
Civil	Rehabilitate Runway	Grading	Dozer
Civil	Rehabilitate Runway	Grading	Grader
Civil	Rehabilitate Runway	Grading	Roller
Civil	Rehabilitate Runway	Hydroseeding	Hydroseeder
Civil	Rehabilitate Runway	Hydroseeding	Off-Road Truck
Civil	Rehabilitate Runway	Lighting	Dump Truck
Civil	Rehabilitate Runway	Lighting	Loader
Civil	Rehabilitate Runway	Lighting	Other General Equipment
Civil	Rehabilitate Runway	Lighting	Pickup Truck
Civil	Rehabilitate Runway	Lighting	Skid Steer Loader
Civil	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe
Civil	Rehabilitate Runway	Markings	Flatbed Truck
Civil	Rehabilitate Runway	Markings	Other General Equipment
Civil	Rehabilitate Runway	Markings	Pickup Truck
Civil	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner
Civil	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)
Civil	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck
Civil	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment
Civil	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck
Civil	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment
Civil	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck
Civil	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps
Civil	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Rehabilitate Runway	Subbase Placement	Dozer
Civil	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)
Civil	Rehabilitate Runway	Subbase Placement	Pickup Truck
Civil	Rehabilitate Runway	Subbase Placement	Roller
Civil	Rehabilitate Runway	Topsoil Placement	Dozer
Civil	Rehabilitate Runway	Topsoil Placement	Dump Truck
Civil	Rehabilitate Runway	Topsoil Placement	Pickup Truck
Civil	Runway Drains	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Runway Drains	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Runway Drains	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Runway Drains	Drainage - 6 inch Perforated Underdrain	Pickup Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Runway Drains	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Runway Drains	Drainage - 24 inch SICPP	Dozer
Civil	Runway Drains	Drainage - 24 inch SICPP	Dump Truck
Civil	Runway Drains	Drainage - 24 inch SICPP	Loader
Civil	Runway Drains	Drainage - 24 inch SICPP	Other General Equipment
Civil	Runway Drains	Drainage - 24 inch SICPP	Pickup Truck
Civil	Runway Drains	Drainage - 24 inch SICPP	Roller
Civil	Runway Drains	Drainage - 24 inch SICPP	Excavator
Civil	Runway Drains	Soil Erosion/Sediment Control	Other General Equipment
Civil	Runway Drains	Soil Erosion/Sediment Control	Pickup Truck
Civil	Runway Drains	Soil Erosion/Sediment Control	Pumps
Civil	Runway Drains	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Runway Extension	Asphalt Placement	Asphalt Paver
Civil	Runway Extension	Asphalt Placement	Dump Truck
Civil	Runway Extension	Asphalt Placement	Other General Equipment
Civil	Runway Extension	Asphalt Placement	Pickup Truck
Civil	Runway Extension	Asphalt Placement	Roller
Civil	Runway Extension	Asphalt Placement	Skid Steer Loader
Civil	Runway Extension	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Runway Extension	Clearing and Grubbing	Chain Saw
Civil	Runway Extension	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Runway Extension	Clearing and Grubbing	Pickup Truck
Civil	Runway Extension	Concrete Placement	Air Compressor
Civil	Runway Extension	Concrete Placement	Concrete Saws
Civil	Runway Extension	Concrete Placement	Concrete Truck
Civil	Runway Extension	Concrete Placement	Other General Equipment
Civil	Runway Extension	Concrete Placement	Pickup Truck
Civil	Runway Extension	Concrete Placement	Rubber Tired Loader
Civil	Runway Extension	Concrete Placement	Slip Form Paver
Civil	Runway Extension	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Runway Extension	Drainage - 24 inch SICPP	Dozer
Civil	Runway Extension	Drainage - 24 inch SICPP	Dump Truck
Civil	Runway Extension	Drainage - 24 inch SICPP	Excavator
Civil	Runway Extension	Drainage - 24 inch SICPP	Loader
Civil	Runway Extension	Drainage - 24 inch SICPP	Other General Equipment
Civil	Runway Extension	Drainage - 24 inch SICPP	Pickup Truck
Civil	Runway Extension	Drainage - 24 inch SICPP	Roller
Civil	Runway Extension	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Runway Extension	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Runway Extension	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Runway Extension	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Runway Extension	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Runway Extension	Dust Control	Water Truck
Civil	Runway Extension	Excavation (Borrow)	Dozer
Civil	Runway Extension	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Runway Extension	Excavation (Borrow)	Pickup Truck
Civil	Runway Extension	Excavation (Borrow)	Roller
Civil	Runway Extension	Excavation (Cut to Fill)	Dozer
Civil	Runway Extension	Excavation (Cut to Fill)	Dump Truck (12 cy)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Runway Extension	Excavation (Cut to Fill)	Excavator
Civil	Runway Extension	Excavation (Cut to Fill)	Pickup Truck
Civil	Runway Extension	Excavation (Cut to Fill)	Roller
Civil	Runway Extension	Excavation (Cut to Fill)	Scraper
Civil	Runway Extension	Excavation (Topsoil Stripping)	Dozer
Civil	Runway Extension	Fencing	Concrete Truck
Civil	Runway Extension	Fencing	Dump Truck
Civil	Runway Extension	Fencing	Other General Equipment
Civil	Runway Extension	Fencing	Pickup Truck
Civil	Runway Extension	Fencing	Skid Steer Loader
Civil	Runway Extension	Fencing	Tractors/Loader/Backhoe
Civil	Runway Extension	Grading	Dozer
Civil	Runway Extension	Grading	Grader
Civil	Runway Extension	Grading	Roller
Civil	Runway Extension	Hydroseeding	Hydroseeder
Civil	Runway Extension	Hydroseeding	Off-Road Truck
Civil	Runway Extension	Lighting	Dump Truck
Civil	Runway Extension	Lighting	Loader
Civil	Runway Extension	Lighting	Other General Equipment
Civil	Runway Extension	Lighting	Pickup Truck
Civil	Runway Extension	Lighting	Skid Steer Loader
Civil	Runway Extension	Lighting	Tractors/Loader/Backhoe
Civil	Runway Extension	Markings	Flatbed Truck
Civil	Runway Extension	Markings	Other General Equipment
Civil	Runway Extension	Markings	Pickup Truck
Civil	Runway Extension	Soil Erosion/Control	Other General Equipment
Civil	Runway Extension	Soil Erosion/Control	Pickup Truck
Civil	Runway Extension	Soil Erosion/Control	Pumps
Civil	Runway Extension	Soil Erosion/Control	Tractors/Loader/Backhoe
Civil	Runway Extension	Subbase Placement	Dozer
Civil	Runway Extension	Subbase Placement	Dump Truck (12 cy)
Civil	Runway Extension	Subbase Placement	Pickup Truck
Civil	Runway Extension	Subbase Placement	Roller
Civil	Runway Extension	Topsoil Placement	Dozer
Civil	Runway Extension	Topsoil Placement	Dump Truck
Civil	Runway Extension	Topsoil Placement	Pickup Truck
Civil	Runway Markings	Marking Removal	Pickup Truck
Civil	Runway Markings	Marking Removal	Pressure Washer
Civil	Runway Markings	Marking Removal	Sweepers/Scrubbers
Civil	Runway Markings	Marking Removal	Water Truck
Civil	Runway Markings	Markings	Flatbed Truck
Civil	Runway Markings	Markings	Other General Equipment
Civil	Runway Markings	Markings	Pickup Truck
Civil	Runway Safety Area	Clearing and Grubbing	Chain Saw
Civil	Runway Safety Area	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Runway Safety Area	Clearing and Grubbing	Pickup Truck
Civil	Runway Safety Area	Drainage	Dozer
Civil	Runway Safety Area	Drainage	Dump Truck
Civil	Runway Safety Area	Drainage	Loader

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Runway Safety Area	Drainage	Other General Equipment
Civil	Runway Safety Area	Drainage	Pickup Truck
Civil	Runway Safety Area	Drainage	Roller
Civil	Runway Safety Area	Drainage - 24 inch SICPP	Excavator
Civil	Runway Safety Area	Dust Control	Water Truck
Civil	Runway Safety Area	Excavation (Borrow)	Dozer
Civil	Runway Safety Area	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Runway Safety Area	Excavation (Borrow)	Pickup Truck
Civil	Runway Safety Area	Excavation (Borrow)	Roller
Civil	Runway Safety Area	Excavation (Cut to Fill)	Dozer
Civil	Runway Safety Area	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Runway Safety Area	Excavation (Cut to Fill)	Excavator
Civil	Runway Safety Area	Excavation (Cut to Fill)	Pickup Truck
Civil	Runway Safety Area	Excavation (Cut to Fill)	Roller
Civil	Runway Safety Area	Excavation (Cut to Fill)	Scraper
Civil	Runway Safety Area	Excavation (Topsoil Stripping)	Dozer
Civil	Runway Safety Area	Fencing	Concrete Truck
Civil	Runway Safety Area	Fencing	Dump Truck
Civil	Runway Safety Area	Fencing	Other General Equipment
Civil	Runway Safety Area	Fencing	Pickup Truck
Civil	Runway Safety Area	Fencing	Skid Steer Loader
Civil	Runway Safety Area	Fencing	Tractors/Loader/Backhoe
Civil	Runway Safety Area	Hydroseeding	Hydroseeder
Civil	Runway Safety Area	Hydroseeding	Off-Road Truck
Civil	Runway Safety Area	Soil Erosion/Sediment Control	Other General Equipment
Civil	Runway Safety Area	Soil Erosion/Sediment Control	Pickup Truck
Civil	Runway Safety Area	Soil Erosion/Sediment Control	Pumps
Civil	Runway Safety Area	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Runway Safety Area	Topsoil Placement	Dozer
Civil	Runway Safety Area	Topsoil Placement	Dump Truck
Civil	Runway Safety Area	Topsoil Placement	Pickup Truck
Civil	Service Road	Asphalt Placement	Asphalt Paver
Civil	Service Road	Asphalt Placement	Dump Truck
Civil	Service Road	Asphalt Placement	Other General Equipment
Civil	Service Road	Asphalt Placement	Pickup Truck
Civil	Service Road	Asphalt Placement	Roller
Civil	Service Road	Asphalt Placement	Skid Steer Loader
Civil	Service Road	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Service Road	Clearing and Grubbing	Chain Saw
Civil	Service Road	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Service Road	Clearing and Grubbing	Pickup Truck
Civil	Service Road	Concrete Placement	Air Compressor
Civil	Service Road	Concrete Placement	Concrete Saws
Civil	Service Road	Concrete Placement	Concrete Truck
Civil	Service Road	Concrete Placement	Other General Equipment
Civil	Service Road	Concrete Placement	Pickup Truck
Civil	Service Road	Concrete Placement	Rubber Tired Loader
Civil	Service Road	Concrete Placement	Slip Form Paver
Civil	Service Road	Concrete Placement	Surfacing Equipment (Grooving)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Service Road	Drainage - 24 inch SICPP	Dozer
Civil	Service Road	Drainage - 24 inch SICPP	Dump Truck
Civil	Service Road	Drainage - 24 inch SICPP	Excavator
Civil	Service Road	Drainage - 24 inch SICPP	Loader
Civil	Service Road	Drainage - 24 inch SICPP	Other General Equipment
Civil	Service Road	Drainage - 24 inch SICPP	Pickup Truck
Civil	Service Road	Drainage - 24 inch SICPP	Roller
Civil	Service Road	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Service Road	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Service Road	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Service Road	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Service Road	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Service Road	Dust Control	Water Truck
Civil	Service Road	Excavation (Borrow)	Dozer
Civil	Service Road	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Service Road	Excavation (Borrow)	Pickup Truck
Civil	Service Road	Excavation (Borrow)	Roller
Civil	Service Road	Excavation (Cut to Fill)	Dozer
Civil	Service Road	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Service Road	Excavation (Cut to Fill)	Excavator
Civil	Service Road	Excavation (Cut to Fill)	Pickup Truck
Civil	Service Road	Excavation (Cut to Fill)	Roller
Civil	Service Road	Excavation (Cut to Fill)	Scraper
Civil	Service Road	Excavation (Topsoil Stripping)	Dozer
Civil	Service Road	Fencing	Concrete Truck
Civil	Service Road	Fencing	Dump Truck
Civil	Service Road	Fencing	Other General Equipment
Civil	Service Road	Fencing	Pickup Truck
Civil	Service Road	Fencing	Skid Steer Loader
Civil	Service Road	Fencing	Tractors/Loader/Backhoe
Civil	Service Road	Grading	Dozer
Civil	Service Road	Grading	Grader
Civil	Service Road	Grading	Roller
Civil	Service Road	Hydroseeding	Hydroseeder
Civil	Service Road	Hydroseeding	Off-Road Truck
Civil	Service Road	Markings	Flatbed Truck
Civil	Service Road	Markings	Other General Equipment
Civil	Service Road	Markings	Pickup Truck
Civil	Service Road	Sidewalks	Concrete Truck
Civil	Service Road	Sidewalks	Dump Truck
Civil	Service Road	Sidewalks	Pickup Truck
Civil	Service Road	Sidewalks	Tractors/Loader/Backhoe
Civil	Service Road	Sidewalks	Vibratory Compactor
Civil	Service Road	Soil Erosion/Sediment Control	Other General Equipment
Civil	Service Road	Soil Erosion/Sediment Control	Pickup Truck
Civil	Service Road	Soil Erosion/Sediment Control	Pumps
Civil	Service Road	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Service Road	Street Lighting	Dump Truck
Civil	Service Road	Street Lighting	Loader

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Service Road	Street Lighting	Other General Equipment
Civil	Service Road	Street Lighting	Pickup Truck
Civil	Service Road	Street Lighting	Skid Steer Loader
Civil	Service Road	Street Lighting	Tractors/Loader/Backhoe
Civil	Service Road	Subbase Placement	Dozer
Civil	Service Road	Subbase Placement	Dump Truck (12 cy)
Civil	Service Road	Subbase Placement	Pickup Truck
Civil	Service Road	Subbase Placement	Roller
Civil	Service Road	Topsoil Placement	Dozer
Civil	Service Road	Topsoil Placement	Dump Truck
Civil	Service Road	Topsoil Placement	Pickup Truck
Civil	Service Road	Tree Planting	Flatbed Truck
Civil	Service Road	Tree Planting	Other General Equipment
Civil	Service Road	Tree Planting	Pickup Truck
Civil	Service Road	Tree Planting	Tractors/Loader/Backhoe
Civil	Taxiway Exit	Asphalt Placement	Asphalt Paver
Civil	Taxiway Exit	Asphalt Placement	Dump Truck
Civil	Taxiway Exit	Asphalt Placement	Other General Equipment
Civil	Taxiway Exit	Asphalt Placement	Pickup Truck
Civil	Taxiway Exit	Asphalt Placement	Roller
Civil	Taxiway Exit	Asphalt Placement	Skid Steer Loader
Civil	Taxiway Exit	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Taxiway Exit	Clearing and Grubbing	Chain Saw
Civil	Taxiway Exit	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Taxiway Exit	Clearing and Grubbing	Pickup Truck
Civil	Taxiway Exit	Concrete Placement	Air Compressor
Civil	Taxiway Exit	Concrete Placement	Concrete Saws
Civil	Taxiway Exit	Concrete Placement	Concrete Truck
Civil	Taxiway Exit	Concrete Placement	Other General Equipment
Civil	Taxiway Exit	Concrete Placement	Pickup Truck
Civil	Taxiway Exit	Concrete Placement	Rubber Tired Loader
Civil	Taxiway Exit	Concrete Placement	Slip Form Paver
Civil	Taxiway Exit	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Dozer
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Dump Truck
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Excavator
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Loader
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Other General Equipment
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Pickup Truck
Civil	Taxiway Exit	Drainage - 24 inch SICPP	Roller
Civil	Taxiway Exit	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Taxiway Exit	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Taxiway Exit	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Taxiway Exit	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Taxiway Exit	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Taxiway Exit	Dust Control	Water Truck
Civil	Taxiway Exit	Excavation (Borrow)	Dozer
Civil	Taxiway Exit	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Taxiway Exit	Excavation (Borrow)	Pickup Truck

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Taxiway Exit	Excavation (Borrow)	Roller
Civil	Taxiway Exit	Excavation (Cut to Fill)	Dozer
Civil	Taxiway Exit	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Taxiway Exit	Excavation (Cut to Fill)	Excavator
Civil	Taxiway Exit	Excavation (Cut to Fill)	Pickup Truck
Civil	Taxiway Exit	Excavation (Cut to Fill)	Roller
Civil	Taxiway Exit	Excavation (Cut to Fill)	Scraper
Civil	Taxiway Exit	Excavation (Topsoil Stripping)	Dozer
Civil	Taxiway Exit	Fencing	Concrete Truck
Civil	Taxiway Exit	Fencing	Dump Truck
Civil	Taxiway Exit	Fencing	Other General Equipment
Civil	Taxiway Exit	Fencing	Pickup Truck
Civil	Taxiway Exit	Fencing	Skid Steer Loader
Civil	Taxiway Exit	Fencing	Tractors/Loader/Backhoe
Civil	Taxiway Exit	Grading	Dozer
Civil	Taxiway Exit	Grading	Grader
Civil	Taxiway Exit	Grading	Roller
Civil	Taxiway Exit	Hydroseeding	Hydroseeder
Civil	Taxiway Exit	Hydroseeding	Off-Road Truck
Civil	Taxiway Exit	Lighting	Dump Truck
Civil	Taxiway Exit	Lighting	Loader
Civil	Taxiway Exit	Lighting	Other General Equipment
Civil	Taxiway Exit	Lighting	Pickup Truck
Civil	Taxiway Exit	Lighting	Skid Steer Loader
Civil	Taxiway Exit	Lighting	Tractors/Loader/Backhoe
Civil	Taxiway Exit	Markings	Flatbed Truck
Civil	Taxiway Exit	Markings	Other General Equipment
Civil	Taxiway Exit	Markings	Pickup Truck
Civil	Taxiway Exit	Soil Erosion/Sediment Control	Other General Equipment
Civil	Taxiway Exit	Soil Erosion/Sediment Control	Pickup Truck
Civil	Taxiway Exit	Soil Erosion/Sediment Control	Pumps
Civil	Taxiway Exit	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Taxiway Exit	Subbase Placement	Dozer
Civil	Taxiway Exit	Subbase Placement	Dump Truck (12 cy)
Civil	Taxiway Exit	Subbase Placement	Pickup Truck
Civil	Taxiway Exit	Subbase Placement	Roller
Civil	Taxiway Exit	Topsoil Placement	Dozer
Civil	Taxiway Exit	Topsoil Placement	Dump Truck
Civil	Taxiway Exit	Topsoil Placement	Pickup Truck
Civil	Taxiways	Asphalt Placement	Asphalt Paver
Civil	Taxiways	Asphalt Placement	Dump Truck
Civil	Taxiways	Asphalt Placement	Other General Equipment
Civil	Taxiways	Asphalt Placement	Pickup Truck
Civil	Taxiways	Asphalt Placement	Roller
Civil	Taxiways	Asphalt Placement	Skid Steer Loader
Civil	Taxiways	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Taxiways	Clearing and Grubbing	Chain Saw
Civil	Taxiways	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Taxiways	Clearing and Grubbing	Pickup Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Taxiways	Concrete Placement	Air Compressor
Civil	Taxiways	Concrete Placement	Concrete Saws
Civil	Taxiways	Concrete Placement	Concrete Truck
Civil	Taxiways	Concrete Placement	Other General Equipment
Civil	Taxiways	Concrete Placement	Pickup Truck
Civil	Taxiways	Concrete Placement	Rubber Tired Loader
Civil	Taxiways	Concrete Placement	Slip Form Paver
Civil	Taxiways	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Taxiways	Drainage - 24 inch SICPP	Dozer
Civil	Taxiways	Drainage - 24 inch SICPP	Dump Truck
Civil	Taxiways	Drainage - 24 inch SICPP	Excavator
Civil	Taxiways	Drainage - 24 inch SICPP	Loader
Civil	Taxiways	Drainage - 24 inch SICPP	Other General Equipment
Civil	Taxiways	Drainage - 24 inch SICPP	Pickup Truck
Civil	Taxiways	Drainage - 24 inch SICPP	Roller
Civil	Taxiways	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Taxiways	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Taxiways	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Taxiways	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Taxiways	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Taxiways	Dust Control	Water Truck
Civil	Taxiways	Excavation (Borrow)	Dozer
Civil	Taxiways	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Taxiways	Excavation (Borrow)	Pickup Truck
Civil	Taxiways	Excavation (Borrow)	Roller
Civil	Taxiways	Excavation (Cut to Fill)	Dozer
Civil	Taxiways	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Taxiways	Excavation (Cut to Fill)	Excavator
Civil	Taxiways	Excavation (Cut to Fill)	Pickup Truck
Civil	Taxiways	Excavation (Cut to Fill)	Roller
Civil	Taxiways	Excavation (Cut to Fill)	Scraper
Civil	Taxiways	Excavation (Topsoil Stripping)	Dozer
Civil	Taxiways	Fencing	Concrete Truck
Civil	Taxiways	Fencing	Dump Truck
Civil	Taxiways	Fencing	Other General Equipment
Civil	Taxiways	Fencing	Pickup Truck
Civil	Taxiways	Fencing	Skid Steer Loader
Civil	Taxiways	Fencing	Tractors/Loader/Backhoe
Civil	Taxiways	Grading	Dozer
Civil	Taxiways	Grading	Grader
Civil	Taxiways	Grading	Roller
Civil	Taxiways	Hydroseeding	Hydroseeder
Civil	Taxiways	Hydroseeding	Off-Road Truck
Civil	Taxiways	Lighting	Dump Truck
Civil	Taxiways	Lighting	Loader
Civil	Taxiways	Lighting	Other General Equipment
Civil	Taxiways	Lighting	Pickup Truck
Civil	Taxiways	Lighting	Skid Steer Loader
Civil	Taxiways	Lighting	Tractors/Loader/Backhoe

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Taxiways	Markings	Flatbed Truck
Civil	Taxiways	Markings	Other General Equipment
Civil	Taxiways	Markings	Pickup Truck
Civil	Taxiways	Soil Erosion/Sediment Control	Other General Equipment
Civil	Taxiways	Soil Erosion/Sediment Control	Pickup Truck
Civil	Taxiways	Soil Erosion/Sediment Control	Pumps
Civil	Taxiways	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Taxiways	Subbase Placement	Dozer
Civil	Taxiways	Subbase Placement	Dump Truck (12 cy)
Civil	Taxiways	Subbase Placement	Pickup Truck
Civil	Taxiways	Subbase Placement	Roller
Civil	Taxiways	Topsoil Placement	Dozer
Civil	Taxiways	Topsoil Placement	Dump Truck
Civil	Taxiways	Topsoil Placement	Pickup Truck
Civil	Terminal Apron	Asphalt Placement	Asphalt Paver
Civil	Terminal Apron	Asphalt Placement	Dump Truck
Civil	Terminal Apron	Asphalt Placement	Other General Equipment
Civil	Terminal Apron	Asphalt Placement	Pickup Truck
Civil	Terminal Apron	Asphalt Placement	Roller
Civil	Terminal Apron	Asphalt Placement	Skid Steer Loader
Civil	Terminal Apron	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Terminal Apron	Clearing and Grubbing	Chain Saw
Civil	Terminal Apron	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Terminal Apron	Clearing and Grubbing	Pickup Truck
Civil	Terminal Apron	Concrete Placement	Air Compressor
Civil	Terminal Apron	Concrete Placement	Concrete Saws
Civil	Terminal Apron	Concrete Placement	Concrete Truck
Civil	Terminal Apron	Concrete Placement	Other General Equipment
Civil	Terminal Apron	Concrete Placement	Pickup Truck
Civil	Terminal Apron	Concrete Placement	Rubber Tired Loader
Civil	Terminal Apron	Concrete Placement	Slip Form Paver
Civil	Terminal Apron	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Terminal Apron	Drainage - 24 inch SICPP	Dozer
Civil	Terminal Apron	Drainage - 24 inch SICPP	Dump Truck
Civil	Terminal Apron	Drainage - 24 inch SICPP	Excavator
Civil	Terminal Apron	Drainage - 24 inch SICPP	Loader
Civil	Terminal Apron	Drainage - 24 inch SICPP	Other General Equipment
Civil	Terminal Apron	Drainage - 24 inch SICPP	Pickup Truck
Civil	Terminal Apron	Drainage - 24 inch SICPP	Roller
Civil	Terminal Apron	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Terminal Apron	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Terminal Apron	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Terminal Apron	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Terminal Apron	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Terminal Apron	Dust Control	Water Truck
Civil	Terminal Apron	Excavation (Borrow)	Dozer
Civil	Terminal Apron	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Terminal Apron	Excavation (Borrow)	Pickup Truck
Civil	Terminal Apron	Excavation (Borrow)	Roller

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Terminal Apron	Excavation (Cut to Fill)	Dozer
Civil	Terminal Apron	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Terminal Apron	Excavation (Cut to Fill)	Excavator
Civil	Terminal Apron	Excavation (Cut to Fill)	Pickup Truck
Civil	Terminal Apron	Excavation (Cut to Fill)	Roller
Civil	Terminal Apron	Excavation (Cut to Fill)	Scraper
Civil	Terminal Apron	Excavation (Topsoil Stripping)	Dozer
Civil	Terminal Apron	Fencing	Concrete Truck
Civil	Terminal Apron	Fencing	Dump Truck
Civil	Terminal Apron	Fencing	Other General Equipment
Civil	Terminal Apron	Fencing	Pickup Truck
Civil	Terminal Apron	Fencing	Skid Steer Loader
Civil	Terminal Apron	Fencing	Tractors/Loader/Backhoe
Civil	Terminal Apron	Grading	Dozer
Civil	Terminal Apron	Grading	Grader
Civil	Terminal Apron	Grading	Roller
Civil	Terminal Apron	Hydroseeding	Hydroseeder
Civil	Terminal Apron	Hydroseeding	Off-Road Truck
Civil	Terminal Apron	Lighting	Dump Truck
Civil	Terminal Apron	Lighting	Loader
Civil	Terminal Apron	Lighting	Other General Equipment
Civil	Terminal Apron	Lighting	Pickup Truck
Civil	Terminal Apron	Lighting	Skid Steer Loader
Civil	Terminal Apron	Lighting	Tractors/Loader/Backhoe
Civil	Terminal Apron	Markings	Flatbed Truck
Civil	Terminal Apron	Markings	Other General Equipment
Civil	Terminal Apron	Markings	Pickup Truck
Civil	Terminal Apron	Sealing/Fuel Resistant	Distributing Tanker
Civil	Terminal Apron	Sealing/Fuel Resistant	Other General Equipment
Civil	Terminal Apron	Sealing/Fuel Resistant	Pickup Truck
Civil	Terminal Apron	Soil Erosion/Sediment Control	Other General Equipment
Civil	Terminal Apron	Soil Erosion/Sediment Control	Pickup Truck
Civil	Terminal Apron	Soil Erosion/Sediment Control	Pumps
Civil	Terminal Apron	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Terminal Apron	Subbase Placement	Dozer
Civil	Terminal Apron	Subbase Placement	Dump Truck (12 cy)
Civil	Terminal Apron	Subbase Placement	Pickup Truck
Civil	Terminal Apron	Subbase Placement	Roller
Civil	Terminal Apron	Topsoil Placement	Dozer
Civil	Terminal Apron	Topsoil Placement	Dump Truck
Civil	Terminal Apron	Topsoil Placement	Pickup Truck
Civil	Tiedowns	Asphalt Placement	Asphalt Paver
Civil	Tiedowns	Asphalt Placement	Dump Truck
Civil	Tiedowns	Asphalt Placement	Other General Equipment
Civil	Tiedowns	Asphalt Placement	Pickup Truck
Civil	Tiedowns	Asphalt Placement	Roller
Civil	Tiedowns	Asphalt Placement	Skid Steer Loader
Civil	Tiedowns	Asphalt Placement	Surfacing Equipment (Grooving)
Civil	Tiedowns	Clearing and Grubbing	Chain Saw

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Tiedowns	Clearing and Grubbing	Chipper/Stump Grinder
Civil	Tiedowns	Clearing and Grubbing	Pickup Truck
Civil	Tiedowns	Concrete Placement	Air Compressor
Civil	Tiedowns	Concrete Placement	Concrete Saws
Civil	Tiedowns	Concrete Placement	Concrete Truck
Civil	Tiedowns	Concrete Placement	Other General Equipment
Civil	Tiedowns	Concrete Placement	Pickup Truck
Civil	Tiedowns	Concrete Placement	Rubber Tired Loader
Civil	Tiedowns	Concrete Placement	Slip Form Paver
Civil	Tiedowns	Concrete Placement	Surfacing Equipment (Grooving)
Civil	Tiedowns	Drainage - 24 inch SICPP	Dozer
Civil	Tiedowns	Drainage - 24 inch SICPP	Dump Truck
Civil	Tiedowns	Drainage - 24 inch SICPP	Excavator
Civil	Tiedowns	Drainage - 24 inch SICPP	Loader
Civil	Tiedowns	Drainage - 24 inch SICPP	Other General Equipment
Civil	Tiedowns	Drainage - 24 inch SICPP	Pickup Truck
Civil	Tiedowns	Drainage - 24 inch SICPP	Roller
Civil	Tiedowns	Drainage - 6 inch Perforated Underdrain	Dump Truck
Civil	Tiedowns	Drainage - 6 inch Perforated Underdrain	Loader
Civil	Tiedowns	Drainage - 6 inch Perforated Underdrain	Other General Equipment
Civil	Tiedowns	Drainage - 6 inch Perforated Underdrain	Pickup Truck
Civil	Tiedowns	Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe
Civil	Tiedowns	Dust Control	Water Truck
Civil	Tiedowns	Excavation (Borrow)	Dozer
Civil	Tiedowns	Excavation (Borrow)	Dump Truck (12 cy)
Civil	Tiedowns	Excavation (Borrow)	Pickup Truck
Civil	Tiedowns	Excavation (Borrow)	Roller
Civil	Tiedowns	Excavation (Cut to Fill)	Dozer
Civil	Tiedowns	Excavation (Cut to Fill)	Dump Truck (12 cy)
Civil	Tiedowns	Excavation (Cut to Fill)	Excavator
Civil	Tiedowns	Excavation (Cut to Fill)	Pickup Truck
Civil	Tiedowns	Excavation (Cut to Fill)	Roller
Civil	Tiedowns	Excavation (Cut to Fill)	Scraper
Civil	Tiedowns	Excavation (Topsoil Stripping)	Dozer
Civil	Tiedowns	Fencing	Concrete Truck
Civil	Tiedowns	Fencing	Dump Truck
Civil	Tiedowns	Fencing	Other General Equipment
Civil	Tiedowns	Fencing	Pickup Truck
Civil	Tiedowns	Fencing	Skid Steer Loader
Civil	Tiedowns	Fencing	Tractors/Loader/Backhoe
Civil	Tiedowns	Grading	Dozer
Civil	Tiedowns	Grading	Grader
Civil	Tiedowns	Grading	Roller
Civil	Tiedowns	Hydroseeding	Hydroseeder
Civil	Tiedowns	Hydroseeding	Off-Road Truck
Civil	Tiedowns	Lighting	Dump Truck
Civil	Tiedowns	Lighting	Loader
Civil	Tiedowns	Lighting	Other General Equipment
Civil	Tiedowns	Lighting	Pickup Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Civil	Tiedowns	Lighting	Skid Steer Loader
Civil	Tiedowns	Lighting	Tractors/Loader/Backhoe
Civil	Tiedowns	Markings	Flatbed Truck
Civil	Tiedowns	Markings	Other General Equipment
Civil	Tiedowns	Markings	Pickup Truck
Civil	Tiedowns	Sealing/Fuel Resistant	Distributing Tanker
Civil	Tiedowns	Sealing/Fuel Resistant	Other General Equipment
Civil	Tiedowns	Sealing/Fuel Resistant	Pickup Truck
Civil	Tiedowns	Soil Erosion/Sediment Control	Other General Equipment
Civil	Tiedowns	Soil Erosion/Sediment Control	Pickup Truck
Civil	Tiedowns	Soil Erosion/Sediment Control	Pumps
Civil	Tiedowns	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe
Civil	Tiedowns	Subbase Placement	Dozer
Civil	Tiedowns	Subbase Placement	Dump Truck (12 cy)
Civil	Tiedowns	Subbase Placement	Pickup Truck
Civil	Tiedowns	Subbase Placement	Roller
Civil	Tiedowns	Tiedowns	Bore/Drill Rig
Civil	Tiedowns	Tiedowns	Concrete Truck
Civil	Tiedowns	Tiedowns	Generator Sets
Civil	Tiedowns	Tiedowns	Other General Equipment
Civil	Tiedowns	Tiedowns	Pickup Truck
Civil	Tiedowns	Tiedowns	Tractors/Loader/Backhoe
Civil	Tiedowns	Topsoil Placement	Dozer
Civil	Tiedowns	Topsoil Placement	Dump Truck
Civil	Tiedowns	Topsoil Placement	Pickup Truck
Vertical	Building - 10000 sqft- 1 story	Concrete Foundations	Tool Truck
Vertical	Building - 10000 sqft- 1 story	Concrete Foundations	Backhoe
Vertical	Building - 10000 sqft- 1 story	Concrete Foundations	Fork Truck
Vertical	Building - 10000 sqft- 1 story	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Building - 10000 sqft- 1 story	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Building - 10000 sqft- 1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Building - 10000 sqft- 1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Building - 10000 sqft- 1 story	Exterior Wall Framing	Fork Truck
Vertical	Building - 10000 sqft- 1 story	Exterior Wall Framing	Man Lift
Vertical	Building - 10000 sqft- 1 story	Exterior Wall Framing	Tractor Trailer- Material Delivery
Vertical	Building - 10000 sqft- 1 story	Exterior Wall Framing	Tool Truck
Vertical	Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Tool Truck
Vertical	Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Fork Truck
Vertical	Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Man Lift

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Building - 10000 sqft- 1 story	Roofing	High Lift
Vertical	Building - 10000 sqft- 1 story	Roofing	Tractor Trailer- Material Delivery
Vertical	Building - 10000 sqft- 1 story	Roofing	Man Lift (Fascia Construction)
Vertical	Building - 10000 sqft- 1 story	Roofing	Material Deliveries
Vertical	Building - 10000 sqft- 1 story	Security & Safety Systems	Tool Truck
Vertical	Building - 10000 sqft- 1 story	Security & Safety Systems	High Lift
Vertical	Building - 10000 sqft- 1 story	Structural Steel Erection	Tractor Trailer- Steel Deliveries
Vertical	Building - 10000 sqft- 1 story	Structural Steel Erection	40 Ton Crane
Vertical	Building - 10000 sqft- 1 story	Structural Steel Erection	Fork Truck
Vertical	Building - 10000 sqft- 1 story	Structural Steel Erection	Tool Truck
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Tool Truck
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Excavator
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Backhoe
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Fork Truck
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Concrete Pump
Vertical	Building - 100000 sqft- 10 stories	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Building - 100000 sqft- 10 stories	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Building - 100000 sqft- 10 stories	Construction Mob & Layout	Survey Crew Trucks
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Fork Truck
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Grout Mixer
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Grout Wheel Truck
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Generator
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Truck Tower (Mantiwoc type)
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Man Lift
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Tractor Trailer- Material Delivery
Vertical	Building - 100000 sqft- 10 stories	Exterior Wall Framing	Tool Truck
Vertical	Building - 100000 sqft- 10 stories	Interior Build-Out/ Finishes	Tool Truck
Vertical	Building - 100000 sqft- 10 stories	Interior Build-Out/ Finishes	Fork Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Building - 100000 sqft- 10 stories	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Building - 100000 sqft- 10 stories	Interior Build-Out/ Finishes	Man Lift
Vertical	Building - 100000 sqft- 10 stories	Roofing	High Lift
Vertical	Building - 100000 sqft- 10 stories	Roofing	Truck Tower (Mantiwoc type)
Vertical	Building - 100000 sqft- 10 stories	Roofing	Tractor Trailer- Material Delivery
Vertical	Building - 100000 sqft- 10 stories	Roofing	Man Lift
Vertical	Building - 100000 sqft- 10 stories	Roofing	Material Deliveries
Vertical	Building - 100000 sqft- 10 stories	Security & Safety Systems	Tool Truck
Vertical	Building - 100000 sqft- 10 stories	Security & Safety Systems	High Lift
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Tractor Trailer- Steel Deliveries
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	90 Ton Crane
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Truck Tower (Mantiwoc type)
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Concrete Pump
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Concrete Truck
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Trowel Machine
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Fork Truck
Vertical	Building - 100000 sqft- 10 stories	Structural Steel Erection & Decks	Tool Truck
Vertical	Building - 30000 sqft- 3 stories	Concrete Foundations	Tool Truck
Vertical	Building - 30000 sqft- 3 stories	Concrete Foundations	Backhoe
Vertical	Building - 30000 sqft- 3 stories	Concrete Foundations	Fork Truck
Vertical	Building - 30000 sqft- 3 stories	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Building - 30000 sqft- 3 stories	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Building - 30000 sqft- 3 stories	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Building - 30000 sqft- 3 stories	Construction Mob & Layout	Survey Crew Trucks
Vertical	Building - 30000 sqft- 3 stories	Exterior Wall Framing	Fork Truck
Vertical	Building - 30000 sqft- 3 stories	Exterior Wall Framing	Man Lift
Vertical	Building - 30000 sqft- 3 stories	Exterior Wall Framing	Generator
Vertical	Building - 30000 sqft- 3 stories	Exterior Wall Framing	Tractor Trailer- Material Delivery
Vertical	Building - 30000 sqft- 3 stories	Exterior Wall Framing	Tool Truck

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Building - 30000 sqft- 3 stories	Interior Build-Out/ Finishes	Tool Truck
Vertical	Building - 30000 sqft- 3 stories	Interior Build-Out/ Finishes	Fork Truck
Vertical	Building - 30000 sqft- 3 stories	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Building - 30000 sqft- 3 stories	Interior Build-Out/ Finishes	Man Lift
Vertical	Building - 30000 sqft- 3 stories	Roofing	High Lift
Vertical	Building - 30000 sqft- 3 stories	Roofing	Tractor Trailer- Material Delivery
Vertical	Building - 30000 sqft- 3 stories	Roofing	Man Lift (Fascia Construction)
Vertical	Building - 30000 sqft- 3 stories	Roofing	Material Deliveries
Vertical	Building - 30000 sqft- 3 stories	Security & Safety Systems	Tool Truck
Vertical	Building - 30000 sqft- 3 stories	Security & Safety Systems	High Lift
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Tractor Trailer- Steel Deliveries
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Tool Truck
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Concrete Pump
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Trowel Machine
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Concrete Truck
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	90 Ton Crane
Vertical	Building - 30000 sqft- 3 stories	Structural Steel Frame	Fork Truck
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Tool Truck
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Excavator
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Backhoe
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Pile Driver
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Caisson Drilling Rig
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Concrete Pump
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Fork Truck
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Building - 500000 sqft- 20 stories	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Building - 500000 sqft- 20 stories	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Building - 500000 sqft- 20 stories	Construction Mob & Layout	Survey Crew Trucks
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Fork Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Grout Mixer
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Grout Wheel Truck
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Generator
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Tower Crane
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Man Lift
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Tractor Trailer- Material Delivery
Vertical	Building - 500000 sqft- 20 stories	Exterior Wall Framing	Tool Truck
Vertical	Building - 500000 sqft- 20 stories	Interior Build-Out/ Finishes	Tool Truck
Vertical	Building - 500000 sqft- 20 stories	Interior Build-Out/ Finishes	Fork Truck
Vertical	Building - 500000 sqft- 20 stories	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Building - 500000 sqft- 20 stories	Interior Build-Out/ Finishes	Man Lift
Vertical	Building - 500000 sqft- 20 stories	Roofing	High Lift
Vertical	Building - 500000 sqft- 20 stories	Roofing	Tower Crane
Vertical	Building - 500000 sqft- 20 stories	Roofing	Tractor Trailer- Material Delivery
Vertical	Building - 500000 sqft- 20 stories	Roofing	Man Lift (Fascia Construction)
Vertical	Building - 500000 sqft- 20 stories	Roofing	Material Deliveries
Vertical	Building - 500000 sqft- 20 stories	Security & Safety Systems	Tool Truck
Vertical	Building - 500000 sqft- 20 stories	Security & Safety Systems	High Lift
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Tractor Trailers- Rebar Deliveries
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	90 Ton Crane Supplemental Hoisting
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Tower Crane
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Concrete Truck Pump
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Concrete Truck
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Trowel Machine
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Fork Truck
Vertical	Building - 500000 sqft- 20 stories	Structural Concrete Frame (20 Stories)	Tool Truck
Vertical	Carwash - 1600 sqft- 1 story	Concrete Foundation Footings	Tool Truck
Vertical	Carwash - 1600 sqft- 1 story	Concrete Foundation Footings	Front Loader/Scraper (to clear lot)
Vertical	Carwash - 1600 sqft- 1 story	Concrete Foundation Footings	Ten Wheelers

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Carwash - 1600 sqft-1 story	Concrete Foundation Footings	Backhoe
Vertical	Carwash - 1600 sqft-1 story	Concrete Foundation Footings	Concrete Ready Mix Trucks
Vertical	Carwash - 1600 sqft-1 story	Concrete Foundation Footings	Concrete Vibrator
Vertical	Carwash - 1600 sqft-1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Carwash - 1600 sqft-1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Carwash - 1600 sqft-1 story	Install EPDM Roofing System	Tractor Trailer- Material Delivery
Vertical	Carwash - 1600 sqft-1 story	Install EPDM Roofing System	High Lift Fork Truck
Vertical	Carwash - 1600 sqft-1 story	Install EPDM Roofing System	Man Lift
Vertical	Carwash - 1600 sqft-1 story	Install Equipment & Start-up	Tractor Trailer- Equipment Delivery
Vertical	Carwash - 1600 sqft-1 story	Install Equipment & Start-up	Set With Fork Truck
Vertical	Carwash - 1600 sqft-1 story	Interior Build-Out/ Finishes/Doors & Windows	Tool Truck
Vertical	Carwash - 1600 sqft-1 story	Interior Build-Out/ Finishes/Doors & Windows	Fork Truck
Vertical	Carwash - 1600 sqft-1 story	Interior Build-Out/ Finishes/Doors & Windows	Tractor Trailer- Material Delivery
Vertical	Carwash - 1600 sqft-1 story	Interior Build-Out/ Finishes/Doors & Windows	Man Lift
Vertical	Carwash - 1600 sqft-1 story	Metal joist/ roof deck/ EPDM Roof	High Lift Fork Truck
Vertical	Carwash - 1600 sqft-1 story	Metal joist/ roof deck/ EPDM Roof	Boom Manlift
Vertical	Carwash - 1600 sqft-1 story	Metal joist/ roof deck/ EPDM Roof	Tractor Trailer- Material Delivery
Vertical	Carwash - 1600 sqft-1 story	Metal joist/ roof deck/ EPDM Roof	Tool Truck
Vertical	Carwash - 1600 sqft-1 story	Pour Slab on Grade Floor	Front Loader
Vertical	Carwash - 1600 sqft-1 story	Pour Slab on Grade Floor	Concrete Ready Mix Trucks
Vertical	Carwash - 1600 sqft-1 story	Pour Slab on Grade Floor	Concrete Pump
Vertical	Carwash - 1600 sqft-1 story	Pour Slab on Grade Floor	Trowel Machine
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Tractor Trailer- Material Delivery
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Man Lift
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Grout Mixer for Mortar
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Concrete Ready Mix Trucks for Cores
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Fork Truck
Vertical	Carwash - 1600 sqft-1 story	Reinforced Masonry Shell	Tool Truck
Vertical	Carwash - 1600 sqft-1 story	Security & Safety & Process Systems	Tool Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Carwash - 1600 sqft- 1 story	Security & Safety & Process Systems	High Lift
Vertical	Carwash - 1600 sqft- 1 story	U'G Services & Tanks	Excavator for U/G Services/Tanks
Vertical	Carwash - 1600 sqft- 1 story	U'G Services & Tanks	Tractor Trailer- Material Delivery
Vertical	Carwash - 1600 sqft- 1 story	U'G Services & Tanks	Hoist Equipment with 40 Ton Rig
Vertical	Carwash - 1600 sqft- 1 story	U'G Services & Tanks	Backfill with Backhoe
Vertical	Convenience Store - 1200 sqft- 1 story	16 Ga. Heavy Metal Framing	Tractor Trailer- Material Delivery
Vertical	Convenience Store - 1200 sqft- 1 story	17 Ga. Heavy Metal Framing	Man Lift
Vertical	Convenience Store - 1200 sqft- 1 story	18 Ga. Heavy Metal Framing	Fork Truck
Vertical	Convenience Store - 1200 sqft- 1 story	19 Ga. Heavy Metal Framing	Tool Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Tool Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Backhoe
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Fork Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Concrete Pump
Vertical	Convenience Store - 1200 sqft- 1 story	Concrete Foundations	Trowel Machines (2)
Vertical	Convenience Store - 1200 sqft- 1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Convenience Store - 1200 sqft- 1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Convenience Store - 1200 sqft- 1 story	Exterior Wall Framing-Panel & Store-Front	Fork Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Exterior Wall Framing-Panel & Store-Front	Boom Manlift
Vertical	Convenience Store - 1200 sqft- 1 story	Exterior Wall Framing-Panel & Store-Front	Tractor Trailer- Material Delivery
Vertical	Convenience Store - 1200 sqft- 1 story	Exterior Wall Framing-Panel & Store-Front	Tool Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Interior Build-Out/ Finishes	Tool Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Interior Build-Out/ Finishes	Fork Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Convenience Store - 1200 sqft- 1 story	Interior Build-Out/ Finishes	Man Lift
Vertical	Convenience Store - 1200 sqft- 1 story	Roofing-Standing Seam	High Lift
Vertical	Convenience Store - 1200 sqft- 1 story	Roofing-Standing Seam	Tractor Trailer- Material Delivery
Vertical	Convenience Store - 1200 sqft- 1 story	Roofing-Standing Seam	Man Lift (Fascia Construction)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Convenience Store - 1200 sqft- 1 story	Security & Safety Systems	Tool Truck
Vertical	Convenience Store - 1200 sqft- 1 story	Security & Safety Systems	High Lift
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Tool Truck
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Front Loader/Scraper (to clear lot)
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Ten Wheelers
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Backhoe
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Concrete Ready Mix Trucks
Vertical	Fire Station - 20000 sqft- 1 story	Concrete Foundation Footings	Concrete Vibrator
Vertical	Fire Station - 20000 sqft- 1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Fire Station - 20000 sqft- 1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Fire Station - 20000 sqft- 1 story	Install EPDM Roofing System	Tractor Trailer- Material Delivery
Vertical	Fire Station - 20000 sqft- 1 story	Install EPDM Roofing System	High Lift Fork Truck
Vertical	Fire Station - 20000 sqft- 1 story	Install EPDM Roofing System	Man Lift
Vertical	Fire Station - 20000 sqft- 1 story	Install Equipment & Start-up	Tractor Trailer- Equipment Delivery
Vertical	Fire Station - 20000 sqft- 1 story	Install Equipment & Start-up	Set With Fork Truck
Vertical	Fire Station - 20000 sqft- 1 story	Interior Build-Out/ Finishes/Doors & Windows	Tool Truck
Vertical	Fire Station - 20000 sqft- 1 story	Interior Build-Out/ Finishes/Doors & Windows	Fork Truck
Vertical	Fire Station - 20000 sqft- 1 story	Interior Build-Out/ Finishes/Doors & Windows	Tractor Trailer- Material Delivery
Vertical	Fire Station - 20000 sqft- 1 story	Interior Build-Out/ Finishes/Doors & Windows	Man Lift
Vertical	Fire Station - 20000 sqft- 1 story	Metal joist/ Floor & roof deck	High Lift Fork Truck
Vertical	Fire Station - 20000 sqft- 1 story	Metal joist/ Floor & roof deck	Boom Manlift
Vertical	Fire Station - 20000 sqft- 1 story	Metal joist/ Floor & roof deck	Tractor Trailer- Material Delivery
Vertical	Fire Station - 20000 sqft- 1 story	Metal joist/ Floor & roof deck	Tool Truck
Vertical	Fire Station - 20000 sqft- 1 story	Pour Slab on Grade Floor & Slab on Metal Deck	Front Loader
Vertical	Fire Station - 20000 sqft- 1 story	Pour Slab on Grade Floor & Slab on Metal	Concrete Ready Mix Trucks
Vertical	Fire Station - 20000 sqft- 1 story	Pour Slab on Grade Floor & Slab on Metal	Concrete Pump
Vertical	Fire Station - 20000 sqft- 1 story	Pour Slab on Grade Floor & Slab on Metal	Trowel Machine
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Tractor Trailer- Material Delivery
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Man Lift

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Grout Mixer for Mortar
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Concrete Ready Mix Trucks for Cores
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Fork Truck
Vertical	Fire Station - 20000 sqft- 1 story	Reinforced Masonry Shell	Tool Truck
Vertical	Fire Station - 20000 sqft- 1 story	Security & Safety & Process Systems	Tool Truck
Vertical	Fire Station - 20000 sqft- 1 story	Security & Safety & Process Systems	High Lift
Vertical	Fire Station - 20000 sqft- 1 story	U'G Services & Tanks	Excavator for U/G Services/Tanks
Vertical	Fire Station - 20000 sqft- 1 story	U'G Services & Tanks	Tractor Trailer- Material Delivery
Vertical	Fire Station - 20000 sqft- 1 story	U'G Services & Tanks	Hoist Equipment with 40 Ton Rig
Vertical	Fire Station - 20000 sqft- 1 story	U'G Services & Tanks	Backfill with Backhoe
Vertical	Gas Station - 1400 sqft- 1 story	Asphalt pavement/ Curbs	Asphalt Deliveries/Ten Wheelers
Vertical	Gas Station - 1400 sqft- 1 story	Asphalt pavement/ Curbs	Asphalt Paving Machine
Vertical	Gas Station - 1400 sqft- 1 story	Asphalt pavement/ Curbs	Front Loader
Vertical	Gas Station - 1400 sqft- 1 story	Asphalt pavement/ Curbs	Roller
Vertical	Gas Station - 1400 sqft- 1 story	Asphalt pavement/ Curbs	Stripping Machine & Truck
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Tool Truck
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Backhoe
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Fork Truck
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Delivery of Tanks (3)
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	40 Ton Crane (to unload & set tanks)
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Gas Station - 1400 sqft- 1 story	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Gas Station - 1400 sqft- 1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Gas Station - 1400 sqft- 1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab Canopies	Tractor Trailer- Material Delivery
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab Canopies	Man Lift
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab Canopies	Fork Truck
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab Canopies	Tool Truck
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab. Attendant Booth	Tractor Trailer- Material Delivery

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab. Attendant Booth	Fork Truck
Vertical	Gas Station - 1400 sqft- 1 story	Pre-Fab. Attendant Booth	Tool Truck
Vertical	Gas Station - 1400 sqft- 1 story	Security & Safety Systems	Tool Truck
Vertical	Gas Station - 1400 sqft- 1 story	Security & Safety Systems	High Lift
Vertical	Hangar Building - 10000 sqft- 1 story	Metal Panels	Fork Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Metal Panels	Man Lift
Vertical	Hangar Building - 10000 sqft- 1 story	Metal Panels	Tractor Trailer- Material Delivery
Vertical	Hangar Building - 10000 sqft- 1 story	Metal Panels	Tool Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Concrete Foundations	Tool Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Concrete Foundations	Backhoe
Vertical	Hangar Building - 10000 sqft- 1 story	Concrete Foundations	Fork Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Hangar Building - 10000 sqft- 1 story	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Hangar Building - 10000 sqft- 1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Hangar Building - 10000 sqft- 1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Hangar Building - 10000 sqft- 1 story	Erection of Pre-Engineered Metal Building	Tractor Trailer- Steel Deliveries
Vertical	Hangar Building - 10000 sqft- 1 story	Erection of Pre-Engineered Metal Building	90 Ton Crane
Vertical	Hangar Building - 10000 sqft- 1 story	Erection of Pre-Engineered Metal Building	High Lift Fork Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Erection of Pre-Engineered Metal Building	Man Lift
Vertical	Hangar Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Tool Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Fork Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery
Vertical	Hangar Building - 10000 sqft- 1 story	Interior Build-Out/ Finishes	Man Lift
Vertical	Hangar Building - 10000 sqft- 1 story	Masonry Wall 4 ft	Grout Mixer for Mortar
Vertical	Hangar Building - 10000 sqft- 1 story	Masonry Wall 4 ft	Masonry Saw
Vertical	Hangar Building - 10000 sqft- 1 story	Masonry Wall 4 ft	Concrete Ready Mix Trucks
Vertical	Hangar Building - 10000 sqft- 1 story	Masonry Wall 4 ft	Tractor Trailer- Truck Delivery
Vertical	Hangar Building - 10000 sqft- 1 story	Pour Interior Slab on Grade	Concrete Ready Mix Trucks
Vertical	Hangar Building - 10000 sqft- 1 story	Pour Interior Slab on Grade	Trowel Machine

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Hangar Building - 10000 sqft- 1 story	Pour Interior Slab on Grade	Concrete Pump
Vertical	Hangar Building - 10000 sqft- 1 story	Roofing	High Lift
Vertical	Hangar Building - 10000 sqft- 1 story	Roofing	Tractor Trailer- Material Delivery
Vertical	Hangar Building - 10000 sqft- 1 story	Roofing	Man Lift (Fascia Construction)
Vertical	Hangar Building - 10000 sqft- 1 story	Roofing	Material Deliveries
Vertical	Hangar Building - 10000 sqft- 1 story	Security & Safety Systems	Tool Truck
Vertical	Hangar Building - 10000 sqft- 1 story	Security & Safety Systems	High Lift
Vertical	Open Parking Lot @Grade - 10000 sqft	Binder Coat of Pavement	Ten Wheelers- Material Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Binder Coat of Pavement	Paving Machine
Vertical	Open Parking Lot @Grade - 10000 sqft	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Open Parking Lot @Grade - 10000 sqft	Construction Mob & Layout	Survey Crew Trucks
Vertical	Open Parking Lot @Grade - 10000 sqft	Curbing	Tractor Trailer with Boom Hoist-Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Curbing	Concrete Ready Mix Trucks
Vertical	Open Parking Lot @Grade - 10000 sqft	Curbing	Bob Cat
Vertical	Open Parking Lot @Grade - 10000 sqft	Curbing	Material Deliveries
Vertical	Open Parking Lot @Grade - 10000 sqft	Grub the site down 2 ft	Bulldozer
Vertical	Open Parking Lot @Grade - 10000 sqft	Grub the site down 2 ft	Front Loader
Vertical	Open Parking Lot @Grade - 10000 sqft	Grub the site down 2 ft	Ten Wheelers
Vertical	Open Parking Lot @Grade - 10000 sqft	Lighting Precast Concrete Piers (10)	Auger Drill
Vertical	Open Parking Lot @Grade - 10000 sqft	Lighting Precast Concrete Piers (10)	Tractor Trailer- Material Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Lighting Precast Concrete Piers (10)	Fork Truck
Vertical	Open Parking Lot @Grade - 10000 sqft	Lighting Precast Concrete Piers (10)	Front Loader
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Bulldozer
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Chain Saws
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Mulcher
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Log Chipper
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Tractor
Vertical	Open Parking Lot @Grade - 10000 sqft	Remove Trees and shrubs	Flat Bed or Dump Trucks
Vertical	Open Parking Lot @Grade - 10000 sqft	Rough Grading	Small Dozer

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Open Parking Lot @Grade - 10000 sqft	Rough Grading	Compacting Equipment
Vertical	Open Parking Lot @Grade - 10000 sqft	Set in-place Light Poles	Tractor Trailer- Material Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Set in-place Light Poles	40 Ton Rough Terrain Crane
Vertical	Open Parking Lot @Grade - 10000 sqft	Set in-place Light Poles	High Lift
Vertical	Open Parking Lot @Grade - 10000 sqft	Stripping	Line Painting Truck and Sprayer
Vertical	Open Parking Lot @Grade - 10000 sqft	Subgrade Materials installed	Tractor Trailer- Material Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Subgrade Materials installed	Backhoe
Vertical	Open Parking Lot @Grade - 10000 sqft	Subgrade Materials installed	Roller
Vertical	Open Parking Lot @Grade - 10000 sqft	Top Coat of Asphalt	Ten Wheelers- Material Delivery
Vertical	Open Parking Lot @Grade - 10000 sqft	Top Coat of Asphalt	Paving Machine
Vertical	Open Parking Lot @Grade - 10000 sqft	Under Ground Conduits	Backhoe
Vertical	Open Parking Lot @Grade - 10000 sqft	Under Ground Conduits	Fork Truck
Vertical	Open Parking Lot @Grade - 10000 sqft	Under Ground Conduits	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Asphalt Pavement-Ground Floor	Front Loader for Subgrade Materials
Vertical	Parking Structure - 160000 sqft- G+1 story	Asphalt Pavement-Ground Floor	Ten Wheelers- Material Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Asphalt Pavement-Ground Floor	Asphalt Paver
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Tool Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Excavator
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Backhoe
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Fork Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Concrete Pump
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Trencher for U/G Piping

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Tractor Trailer- Stone Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Concrete Foundations	Front Loader
Vertical	Parking Structure - 160000 sqft- G+1 story	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Parking Structure - 160000 sqft- G+1 story	Construction Mob & Layout	Survey Crew Trucks
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Concrete Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	40 Ton Rough Terrain Crane
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Concrete Pump
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Trowel Machines (2)
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Fork Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Horizontal Deck Pours	Tool Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Lights and Power	Trencher
Vertical	Parking Structure - 160000 sqft- G+1 story	Lights and Power	Tool Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Lights and Power	High Lift
Vertical	Parking Structure - 160000 sqft- G+1 story	Lights and Power	Forklift
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	Fork Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	Man Lift
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	40 Ton Rough Terrain Crane
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	Grout Mixer

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 160000 sqft- G+1 story	Parapet Wall Construction	Tool Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Security & Safety Systems	Tool Truck
Vertical	Parking Structure - 160000 sqft- G+1 story	Security & Safety Systems	High Lift
Vertical	Parking Structure - 160000 sqft- G+1 story	Site Prep/Landscaping	Tractor Trailer with Boom Hoist- Curbs Del & Place
Vertical	Parking Structure - 160000 sqft- G+1 story	Site Prep/Landscaping	Tractor Trailer- Topsoil & Seed
Vertical	Parking Structure - 160000 sqft- G+1 story	Site Prep/Landscaping	Front Loader
Vertical	Parking Structure - 160000 sqft- G+1 story	Structural Steel Erection & Metal Deck	Tractor Trailer- Steel Deliveries
Vertical	Parking Structure - 160000 sqft- G+1 story	Structural Steel Erection & Metal Deck	90 Ton Crane
Vertical	Parking Structure - 160000 sqft- G+1 story	Structural Steel Erection & Metal Deck	Concrete Pump
Vertical	Parking Structure - 240000 sqft- G+2 stories	Asphalt Pavement-Ground Floor	Front Loader for Subgrade Materials
Vertical	Parking Structure - 240000 sqft- G+2 stories	Asphalt Pavement-Ground Floor	Ten Wheelers- Material Delivery
Vertical	Parking Structure - 240000 sqft- G+2 stories	Asphalt Pavement-Ground Floor	Asphalt Paver
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Tool Truck
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Excavator
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Backhoe
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Caisson Drilling Rig
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	40 Ton Rough Terrain Crane
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Concrete Pump
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Fork Truck

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Concrete Ready Mix Trucks
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Trencher for U/G Piping
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Tractor Trailer- Stone Delivery
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Foundations	Front Loader
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Post-Tensioned Frame	Tractor Trailer- Steel Deliveries
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Post-Tensioned Frame	90 Ton Crane
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Post-Tensioned Frame	Concrete Ready Mix Trucks
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Post-Tensioned Frame	Concrete Boom Pump
Vertical	Parking Structure - 240000 sqft- G+2 stories	Concrete Post-Tensioned Frame	Trowel Machines (4)
Vertical	Parking Structure - 240000 sqft- G+2 stories	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Parking Structure - 240000 sqft- G+2 stories	Construction Mob & Layout	Survey Crew Trucks
Vertical	Parking Structure - 240000 sqft- G+2 stories	Lights and Power	Trencher
Vertical	Parking Structure - 240000 sqft- G+2 stories	Lights and Power	Tool Truck
Vertical	Parking Structure - 240000 sqft- G+2 stories	Lights and Power	High Lift
Vertical	Parking Structure - 240000 sqft- G+2 stories	Lights and Power	Forklift
Vertical	Parking Structure - 240000 sqft- G+2 stories	Precast Concrete Exterior Panels	Fork Truck
Vertical	Parking Structure - 240000 sqft- G+2 stories	Precast Concrete Exterior Panels	Tractor Trailer- Material Delivery
Vertical	Parking Structure - 240000 sqft- G+2 stories	Precast Concrete Exterior Panels	40 Ton Rough Terrain

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Parking Structure - 240000 sqft- G+2 stories	Security & Safety Systems	Tool Truck
Vertical	Parking Structure - 240000 sqft- G+2 stories	Security & Safety Systems	High Lift
Vertical	Parking Structure - 240000 sqft- G+2 stories	Site Prep/Landscaping	Tractor Trailer with Boom Hoist- Curbs Del & Place
Vertical	Parking Structure - 240000 sqft- G+2 stories	Site Prep/Landscaping	Truck for Topsoil & Seed Del & Spread
Vertical	Parking Structure - 240000 sqft- G+2 stories	Site Prep/Landscaping	Front Loader
Vertical	Site Work - 10000 sqft	Construction Mob & Layout	Tractor Trailers Temp Fac.
Vertical	Site Work - 10000 sqft	Construction Mob & Layout	Survey Crew Trucks
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Bulldozer
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Chain Saws
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Mulcher
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Log Chipper
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Tractor
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Flat Bed or Dump Trucks
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Grub the site down 2 ft
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Front Loader
Vertical	Site Work - 10000 sqft	Site Clearing- Remove Trees & Shrubs	Ten Wheelers
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Curbing)	Tractor Trailer with Boom Hoist- Delivery
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Curbing)	Concrete Ready Mix Trucks
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Curbing)	Bob Cat
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Rough Grading)	Small Dozer
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Rough Grading)	Compacting Equipment
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Top Soil Seed and Plantings)	Tractor Trailer- Material Delivery
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Top Soil Seed and Plantings)	Roller
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Top Soil Seed and Plantings)	Seed Truck Spreader
Vertical	Site Work - 10000 sqft	Site Restoration- Landscaping (Top Soil Seed and Plantings)	Forktruck (Hoist)

(continued on next page)

Table B-5. (Continued).

Project Category	Project	Construction Activities	Equipment
Vertical	Site Work - 10000 sqft	Underground Services to 5ft of building	Backhoe
Vertical	Site Work - 10000 sqft	Underground Services to 5ft of building	Fork Truck
Vertical	Site Work - 10000 sqft	Underground Services to 5ft of building	Tractor Trailer- Material Delivery
Vertical	Demolition - Concrete	Concrete Demolition	Excavator with Hoe Ram
Vertical	Demolition - Concrete	Concrete Demolition	Excavator with Bucket
Vertical	Demolition - Concrete	Concrete Demolition	Pickup Truck
Vertical	Demolition - Asphalt	Asphalt Demolition	Excavator
Vertical	Demolition - Asphalt	Asphalt Demolition	Dozer
Vertical	Demolition - Asphalt	Asphalt Demolition	Pickup Truck
Vertical	Demolition - Building	Building Demolition	Excavator with Bucket
Vertical	Demolition - Building	Building Demolition	Pickup Truck
Vertical	Demolition - Building	Building Demolition	Bob Cat
Vertical	Demolition - Building	Building Demolition	Generator Sets
Vertical	Demolition - Building	Building Demolition	Dump Truck



APPENDIX C

Minimum Data Requirements for ACEIT

The following information provides a list of the minimum information required to develop an airport construction emissions inventory within ACEIT.

C.1 Setup Data

- Study Name: A short study name used to identify the study.
- Description: A description/summary of the study to help further identify and recall details of the study.
- State: The state within which the project will occur.
- County: The county within which the project will occur.
- Year: The year during which the project (or portion) will occur.
- Number of Months: The number of months the project (or portion of) will occur.
- Season: The season (summer or winter) the project (or portion of) will occur.
- Average Daily Temp (deg F): The average daily temperature estimate for the duration of the project (or portion of).
- Max Daily Temp Change (deg F): The average estimate for the maximum daily temperature change.
- Min Daily Temp Change (deg F): The average estimate for the minimum daily temperature change.

C.2 Project Data

- Selection of the project from the existing list.
- Selection of construction activities corresponding to the selected project.
- Selection of fuel type (diesel or gasoline) for each type of equipment.
- Final selection of the project-activity-equipment-fuel combinations.

C.3 Overall Size Data

Table C-1. Minimum overall project size data.

Project	Question	Units
Access Road	What is the maximum length of the road (L) in feet?	Feet
Access Road	What is the maximum width of the road including shoulder (W) in feet?	Feet
Access Road	What is the estimated cost of the project?	\$ Million(s)
Airfield Lighting	What is the maximum length of lighting project (L) in feet? - Includes lights on both sides of runway.	Feet
Airfield Lighting	What is the estimated cost of the project?	\$ Million(s)
Apron (GA)	What is the maximum length of the apron (L) in feet?	Feet
Apron (GA)	What is the maximum width of the apron (W) in feet?	Feet
Apron (GA)	What is the estimated cost of the project?	\$ Million(s)
Cargo Apron	What is the maximum length of the cargo apron (L) in feet?	Feet
Cargo Apron	What is the maximum width of the cargo apron (W) in feet?	Feet
Cargo Apron	What is the estimated cost of the project?	\$ Million(s)
Detention Basin	What is the maximum length of the detention basin (L) in feet?	Feet
Detention Basin	What is the maximum width of the detention basin (W) in feet?	Feet
Detention Basin	What is the maximum depth of the detention basin (D) in feet?	Feet
Detention Basin	What is the estimated cost of the project?	\$ Million(s)
Drainage System	What is the maximum length of the drainage system (L) in feet?	Feet
Drainage System	What is the maximum width of the drainage system (W) in feet?	Feet
Drainage System	What is the maximum depth of the drainage system (D) in feet?	Feet
Drainage System	What is the estimated cost of the project?	\$ Million(s)
Fencing	What is the maximum length of the fence (L) in feet?	Feet
Fencing	What is the estimated cost of the project?	\$ Million(s)
Fuel Tanks	What is the maximum length of the fuel tank area (L) in feet?	Feet
Fuel Tanks	What is the maximum width of the fuel tank area (W) in feet?	Feet
Fuel Tanks	What is the maximum depth (D) of excavation for the fuel tanks in feet?	Feet
Fuel Tanks	What is the number of tanks (T) to be installed?	---
Fuel Tanks	What is the estimated cost of the project?	\$ Million(s)
Helipad	What is the maximum length of the helipad (L) in feet?	Feet
Helipad	What is the maximum width of the helipad (W) in feet?	Feet
Helipad	What is the estimated cost of the project?	\$ Million(s)
Landscaping	What is the maximum length of the project area (L) in feet?	Feet
Landscaping	What is the maximum width of the project area (W) in feet?	Feet
Landscaping	What is the number of trees planted?	---

Table C-1. (Continued).

Project	Question	Units
Landscaping	What is the number of trees pruned?	---
Landscaping	What is the estimated cost of the project?	\$ Million(s)
NAVAIDS	What is the number of precision approach path indicators (PAPIs) to be installed?	---
NAVAIDS	What is the number of instrument landing system glide slopes (ILS-GS) to be installed?	---
NAVAIDS	What is the number of instrument landing system localizers (ILS-L) to be installed?	---
NAVAIDS	What is the number of approach lighting (AL) lights indicated to be installed?	---
NAVAIDS	What is the number of rotating beacons (RB) to be installed?	---
NAVAIDS	What is the number of windcones (WC) to be installed?	---
NAVAIDS	What is the maximum length of the project area (L) in feet?	Feet
NAVAIDS	What is the maximum width of the project area (W) in feet?	Feet
NAVAIDS	What is the estimated cost of the project?	\$ Million(s)
New Runway	What is the maximum length of the new runway (L) in feet?	Feet
New Runway	What is the maximum width of the new runway (W) in feet?	Feet
New Runway	What is the estimated cost of the project?	\$ Million(s)
Noise Barrier	What is the maximum height of the barrier (H) in feet?	Feet
Noise Barrier	What is the maximum length of the barrier (L) in feet?	Feet
Noise Barrier	What is the maximum width of the barrier (W) in feet?	Feet
Noise Barrier	What is the estimated cost of the project?	\$ Million(s)
Parking Lot	What is the maximum length of the parking lot (L) in feet?	Feet
Parking Lot	What is the maximum width of the parking lot (W) in feet?	Feet
Parking Lot	What is the estimated cost of the project?	\$ Million(s)
Rehabilitate Runway	What is the maximum length of rehabilitation (L) in feet?	Feet
Rehabilitate Runway	What is the maximum width of rehabilitation (W) in feet?	Feet
Rehabilitate Runway	What is the estimated cost of the project?	\$ Million(s)
Runway Drains	What is the maximum length (L) of the drainage system installed (perforated pipe and main sewer) in feet? - Perforated underdrain is typically installed on both sides of runway and/or taxiway.	Feet
Runway Drains	What is the maximum width of the runway drains (W) in feet?	Feet
Runway Drains	What is the estimated cost of the project?	\$ Million(s)
Runway Extension	What is the maximum length of the runway extension (L) in feet?	Feet
Runway Extension	What is the maximum width of the runway extension (W) in feet?	Feet
Runway Extension	What is the estimated cost of the project?	\$ Million(s)
Runway Markings	What is the maximum length of the markings (L) in feet?	Feet
Runway Markings	What is the maximum width of the markings (W) in feet?	Feet
Runway Markings	What is the estimated cost of the project?	\$ Million(s)

(continued on next page)

Table C-1. (Continued).

Project	Question	Units
Runway Safety Area	What is the maximum length of the runway safety area (L) in feet?	Feet
Runway Safety Area	What is the maximum width of the runway safety area (W) in feet?	Feet
Runway Safety Area	What is the estimated cost of the project?	\$ Million(s)
Service Road	What is the maximum length of the service road (L) in feet?	Feet
Service Road	What is the maximum width of the service road (W) in feet?	Feet
Service Road	What is the estimated cost of the project?	\$ Million(s)
Taxiways	What is the maximum length of the taxiway (L) in feet?	Feet
Taxiways	What is the maximum width of the taxiway (W) in feet?	Feet
Taxiways	What is the estimated cost of the project?	\$ Million(s)
Taxiway Exit	What is the maximum length of the taxiway exit (L) in feet?	Feet
Taxiway Exit	What is the maximum width of the taxiway exit (W) in feet?	Feet
Taxiway Exit	What is the estimated cost of the project?	\$ Million(s)
Terminal Apron	What is the maximum length of the terminal apron (L) in feet?	Feet
Terminal Apron	What is the maximum width of the terminal apron (W) in feet?	Feet
Terminal Apron	What is the estimated cost of the project?	\$ Million(s)
Tiedowns	What is the maximum number of tiedowns that will be installed?	---
Tiedowns	What is the maximum length of the tiedown area (L) in feet?	Feet
Tiedowns	What is the maximum width of the tiedown area (W) in feet?	Feet
Tiedowns	What is the estimated cost of the project?	\$ Million(s)
Building - 10000 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Building - 100000 sqft- 10 stories	What is the estimated cost of the project?	\$ Million(s)
Building - 30000 sqft- 3 stories	What is the estimated cost of the project?	\$ Million(s)
Building - 500000 sqft- 20 stories	What is the estimated cost of the project?	\$ Million(s)
Carwash - 1600 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Convenience Store - 1200 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Fire Station - 20000 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Gas Station - 1400 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Hangar Building - 10000 sqft- 1 story	What is the estimated cost of the project?	\$ Million(s)
Open Parking Lot @Grade - 10000 sqft	What is the estimated cost of the project?	\$ Million(s)
Parking Structure - 160000 sqft- G+1 story	What is the estimated cost of the project?	\$ Million(s)

Table C-1. (Continued).

Project	Question	Units
Parking Structure - 240000 sqft- G+2 stories	What is the estimated cost of the project?	\$ Million(s)
Site Work - 10000 sqft	What is the estimated cost of the project?	\$ Million(s)
Demolition - Asphalt	What is the maximum length of demolition area (L) in feet?	Feet
Demolition - Asphalt	What is the maximum width of demolition area (W) in feet?	Feet
Demolition - Asphalt	What is the estimated cost of the project?	\$ Million(s)
Demolition - Concrete	What is the maximum length of demolition area (L) in feet?	Feet
Demolition - Concrete	What is the maximum width of demolition area (W) in feet?	Feet
Demolition - Concrete	What is the estimated cost of the project?	\$ Million(s)
Demolition - Building	How many square feet of building will be demolished?	Square Feet
Demolition - Building	What is the estimated cost of the project?	\$ Million(s)
Demolition - Building	What is the height of building (H) in feet?	Feet
Demolition - Building	What is the open space height (H) in feet?	Feet

APPENDIX D

ACEIT Assumptions List

The following list of assumptions and notes is a facsimile of the list that can be found at the end of each ACEIT output file.

Emission factors were developed from the following models:

On-Road Vehicles: MOVES 2010b, revised January 2013

Non-Road Equipment: NONROAD 2008a, July 2009

In addition to the overall project size dimensions (e.g., length and width) provided by the user, an additional 10-ft length and 10-ft width is added to account for disturbance areas.

The number of employees is based on the higher of two methods: (1) number of equipment and (2) multiply the project cost in million by 11.

The average employee travels 30 miles round-trip from home to construction site each day.

The average on-road material delivery round-trip distance per truck is 40 miles per day.

For calculating fugitive, re-entrained PM emissions from on-road and non-road material delivery and handling equipment, a nominal VMT of 5 miles is used for each vehicle per day.

In deriving emission factors from NONROAD, the horsepower for each type of equipment represents the most popular in each equipment category.

The total length of each modeled scenario is used to define the number of days associated with vehicle/equipment evaporative emissions.

The choice of location and season are assumed to adequately represent differences in fuel characteristics affecting emissions.

Only two seasons (summer and winter) are used to represent all seasons.

14 U.S. counties are used to represent all other counties in the U.S. (all other counties are mapped to the 14).

The default methods assume that all construction equipment uses diesel as well as heavy-duty on-road vehicles, while passenger vehicles (including motorcycles) use gasoline.

Fugitive emissions are only modeled for:

- Asphalt drying
- Asphalt storage and batching
- Concrete mixing/batching
- Soil handling
- Unstabilized land and wind erosion
- Material movement (unpaved roads)
- Material movement (paved roads)

On-Road vehicle speeds are not explicitly modeled. The associated emission factors for each modeled vehicle from MOVES represent averages over the driving cycles, the roadway type, and daily temperature variations.

The default equipment hours-of-use data are developed based on the overall size of the project provided by the user and activity rates based on expert engineering judgment.

Under the Construction Activity Type list (Activity Tab), when a choice between asphalt and concrete materials occurs, asphalt is always selected as default. To choose concrete, de-select the asphalt item and select the corresponding concrete item.

Two trips per day were assumed for each on-road material handling trucks.

Only CO₂, CH₄, and N₂O are used to represent greenhouse gas emissions. Other potential greenhouse gases including air conditioning refrigerants were not included.

The following equipment is always modeled using diesel emission factors since gasoline-based emission factors are not available:

- Asphalt Deliveries/Ten Wheelers
- Bulldozer
- Concrete Ready Mix Trucks
- Concrete Ready Mix Trucks for Cores
- Concrete Truck
- Crack Filler (Trailer Mounted)
- Delivery of Tanks (3)
- Distributing Tanker
- Dozer
- Dump Truck
- Dump Truck (12 cy)
- Excavator
- Excavator for U/G Services/Tanks
- Flatbed or Dump Trucks
- Flatbed Truck
- Grader
- Grout Wheel Truck
- Hoist Equipment with 40 Ton Rig
- Hydraulic Hammer
- Hydroseeder
- Line Painting Truck and Sprayer
- Material Deliveries
- Off-Road Truck
- Pickup Truck
- Scraper
- Seed Truck Spreader
- Small Dozer
- Survey Crew Trucks
- Ten Wheelers
- Ten Wheelers - Material Delivery
- Tool Truck
- Tractor Trailer - Equipment Delivery
- Tractor Trailer - Material Delivery
- Tractor Trailer - Steel Deliveries

Tractor Trailer - Stone Delivery
Tractor Trailer - Topsoil & Seed
Tractor Trailer - Truck Delivery
Tractor Trailer with Boom Hoist - Curbs Del & Place
Tractor Trailer with Boom Hoist - Delivery
Tractor Trailers - Rebar Deliveries
Tractor Trailers Temp Fac.
Truck for Topsoil & Seed Del & Spread
Water Truck
Excavator with Bucket
Excavator with Hoe Ram

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International-North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation